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WINDOW OPERATION FOR HEMATOMA AURIS AND PERICHONDRITIS WITH EFFUSION.*†

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The present paper is in the nature of a revision, and supplementary report, of the one which I read on the same subject before the Otology Section of the New York Academy of Medicine on Feb. 8, 1929, and which was published in THE LARYNGOSCOPE of September, 1929.

My original report was based on a total of seven cases. This one is founded on the results obtained in 26 cases that were operated by me and associates on the services of the New York Polyclinic Medical School and Hospital.

Traumatic swellings beneath the perichondrium of the anterior surface of the auricle are often refractory to treatment and unsatisfactory in results when dealt with by the generally accepted methods. They are produced most frequently by a blow on the ear, and are much more common among boxers and wrestlers than in any other class, although found in football players, acrobats, the insane and aged; also in piano movers from pressure on the ear in lifting upright pianos;

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in butchers from the pressure of large sections of beef resting against the ear while being carried on the shoulder, and from much milder trauma, as in one of my patients who, when a boy, had the habit of fingering or "foxing" his ear, as he called it, which caused exudation and permanent thickening (see Fig. 1).

The usual modes of treatment are often tedious, prolonged and unsatisfactory, both to the patient and surgeon, requiring a great deal of time and patience in the adjustment of the various pressure devices, casts and dressings, where aspiration is employed, or where incision with or without drainage is used pressure dressings are usually recommended, consuming much of the surgeon's time, causing inconvenience and embarrassment to the patient, with results that leave much to be desired (see Fig. 2).

With these thoughts and experiences in mind, nearly seven years ago I devised and applied to these auricular conditions an operative procedure which was based in principle on a method which I had used continually for more than 14 years previously in dealing with almost identical lesions in the nasal septum.

For the past 21 years or more I have used in one way or another the method of punching windows out of the mucoperichondrial layer of the septum to afford prompt and efficient drainage of abscesses and hematomata of the nasal septum, either following the submucous resection, injuries to the nose resulting in these conditions, or others of unknown etiology in a great many instances, and I have found it the simplest as well as the best way of dealing with these troublesome and often deforming complications.

The likelihood of disfigurement of the face from absorption of the cartilage of the septum, and the removal of this support from the bridge, I am sure, is much less when this method of drainage is used than where simple incision and a drain of guttapercha, rubber dam, gauze or other drainage material is employed.

This rhinological background dealing with a large number of patients with analogous conditions, treated almost identically and observed, many of them over a long period of time, for deformity and results, coupled with the present considera-

ble number of the auricular cases, some of them operated nearly seven years ago, and presented here tonight, together with patients who have been treated and operated by other methods, shown for purposes of comparison, for your observation and study, will, I feel, go a long way toward establishing the satisfactoriness of this procedure in dealing with these trying, unsightly and sometimes dangerous otological conditions (see Figs. 7 and 8).

Description: Hematoma auris or othematoma, and perichondritis with serous effusion, although usually thought of and described as separate entities, as seen clinically the two

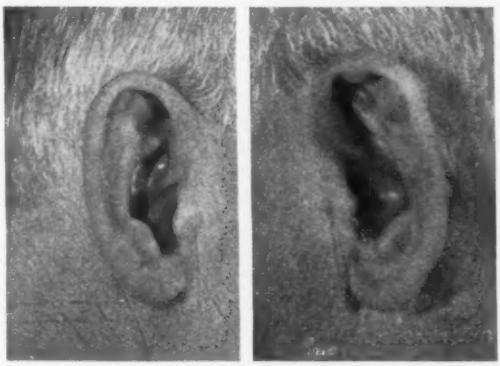

Fig. 1. Nodules in the auricles of a man who, as a boy, had the habit of "foxing" or fingering his ears. The mild traumatism, frequently repeated, causing subperichondrial effusions with subsequent organization into dense masses.

conditions or processes seem to be practically always combined, and the preponderance of the one over the other determines the diagnosis; for example, when trauma results in the extravasation of considerable blood between the perichondrium and cartilage, the same factor trauma which causes the damage to the blood vessels and bleeding also sets up a reaction in the perichondrium with exudation of serum; but if the trauma is severe enough and does not rupture any blood vessels of consequence the reaction of the perichondrium will be to throw out an exudate of serum with very little of the blood cellular elements, and the result in the latter case is perichondritis with serous effusion; and in the former, hema-

toma auris, depending on whether the serous or cellular elements abound. In some instances very mild irritation, especially if frequently repeated, will set up the same process and the result is the same, although usually more limited, and the fluid elements are in excess with very little of the blood cellular content present; however, the resulting late organized nodule appears to be very much the same in either case.

When the hematoma or perichondrial effusion becomes infected we have very much the same process as in suppurative perichondritis following the radical mastoid operation; but since this latter is usually thought of as a separate clinical entity, although in reality it is just a variety or subdivision of perichondritis with effusion, as used in this paper; but this postoperative suppurative perichondritis is apt to be more fulminating, and often requires extensive multiple windows through the anterior skin-perichondrial layer, and the cartilage as well to give adequate drainage behind; whereas, in the usual traumatic hematoma auris and perichondritis with effusion a single large window is usually sufficient. For these reasons postmastoidectomy suppurative perichondritis will receive some separate discussion later.

Since the skin and perichondrium of the anterior surface of the pinna are densely adherent and form practically one layer, but the perichondrium is only loosely attached to the chondrium on this surface; however, posteriorly the perichondrium is densely adherent to the cartilage by fibrous trabeculae and separates with difficulty from it; whereas, the skin is loosely attached to the posterior perichondrial layer by areolar tissue and easily becomes edematous; but is more protected, and does not bear the brunt of trauma as does the outer surface. The inner surface is rarely involved except where the cartilage is fractured from severe trauma or in extensive suppurative perichondritis following mastoidectomy.

The tumefaction is most apt to form in the concha auriculae, or at the upper pole of the anterior surface, or the whole outer aspect (see Fig. 8) may be involved, except the lobule, which contains no cartilage, unless there are embryonic anomalies, and this serves as a differential point between these subperichondrial processes and those of an erysipelatoid,

cellulitic or dermatitic nature which readily affect the loose lobular structure.

Frost bite has been mentioned as a cause, but it is most likely that the rubbing so often employed under these circumstances is the exciting factor.

These conditions in the past were so common among inmates of insane asylums that they were considered symptomatic; however, it is difficult or impossible to rule out some form of trauma in these cases. Calcification and hard-

Fig. 2.

Fig 3.

Fig. 2. Deformed, thickened ear that was incised, clot evacuated, cavity packed and tight dressings applied 15 years ago.

Fig. 3. Case J. H. Window operation twice performed for large effusions. The first, 14 months ago, when the cartilage was fractured, skin lacerated and infected effusion front and back. Another injury and swelling one year later. Resulting ear normal in every way. Scars hidden under antihelix.

ening of the cartilage and blood vessels are probably predisposing factors in these psychiatric cases, and certainly hemophilia would be a predisposing factor where present.

When infected the process is much more severe and the signs of inflammation — redness, heat, pain and swelling — are very pronounced, and call for prompt and free drainage by means of ample window formation.

The swelling is usually oval in shape; the long axis of which is roughly parallel to the long axis of the auricle, which

is from above downward and the transverse diameter is apt to measure about four-fifths its long or vertical diameter. The surface has a bluish red color, definitely fluctuating to touch, except in the early stage of clot formation, or later when organization has taken place.

To transillumination, clot and late organization show dark, whereas serous exudate is clearer and transmits the light more freely.

In most instances, if seen a week or more after the injury has occurred, the cartilage will show signs of necrosis and absorption; as evidenced by loss of lustre, roughening or pitting of surface, greater flexibility and loss of resiliency; also thickening and induration of the perichondrium, and later a tendency to encapsulation, organization, and still later osteochondromatous formation, in some cases at least.

Absorption of the cartilage takes place much more rapidly when the fluid is purulent and the pain severe. When not infected, the pain, tenderness and fever are slight, or of moderate degree.

Purulent perichondritis may result from furunculosis of the meatus, or infection following trauma to the auricle, or plastic operations on the meatus.

Treatment: If seen immediately after trauma has been received firm pressure of cold compresses, or of a towel saturated with ice water and frequently renewed, with pressure exerted by the hand against these and steadily maintained for 20 to 30 minutes or more to control and prevent extravasation of blood and serum into the tissues, should be used. Later, cold in the form of a light ice bag, with a towel interposed, should be kept applied for 24 to 48 hours, depending on the severity of the injury, after which warmth may be employed.

Within two to four days unless the swelling is small and shows a definite tendency to rapid absorption, or in any case if the swelling is of medium or large size and is located between the perichondrium and cartilage, the window operation should be performed, as these tumefactions in this region nearly always leave permanent thickening unless this is done. However, it is desirable in most cases, except for controlling

reasons, such as infection, to wait for two to four days after injury for the damaged blood vessels to occlude before making the window, and thus lessen the possibility of formation of a secondary clot.

WINDOW OPERATION.

The auricle is sterilized by the application of half-strength iodine tincture to the skin of this region, and the excess removed with alcohol, very much as when preparing for the mastoid operation, except the field is more limited, and the side of the head over the temporal, parietal and mastoid

Fig. 4.

Fig. 5.

Fig. 4. Case C. W. Osteochondromatous mass in outer face, blocking completely left meatus and deafness.

Fig. 5. Case C. W. Just healed after removal of organized swelling by window operation. Meatus open, hearing restored, ear fast returning to normal.

regions are not ordinarily included. The patient is draped, following the usual operating room technique. A sterile solution containing 1 per cent of procain and a trace of adrenalin chloride (1:50,000) is injected beneath the epidermis covering the greater part of the swelling.

In general, the windows should be curves, so placed that when healing is completed they will be hidden under folds or ridges or in a depression, as the visibility is least in these locations, and the windows should conform to and be made

parallel to the curved structures of the auricle; for example, the helix, antihelix and crura, as represented in Fig. 9. Most often the window can be placed so that when healing has taken place the scar will be hidden under the ledge of the antihelix in the cavum conchae or cymba conchae, or under one of the crura. Also if the swelling is near the margin of pinna the window should be made so that the scar will be hidden under the projecting edge of the helix.

The illustrations will bring out clearly these points about placement of scars. However, it is surprising how little scarring follows even where no great attempt along these lines is made, as in the early cases before all these details had been worked out. Nevertheless, in all cases the window should represent the arc of a circle and should be concentric with the natural curved lines of the auricle (see Fig. 13).

In length the window should be from two-thirds to three-fourths the long diameter of the swelling, and in width it should be 2.5 mm., or about two-sixteenths of an inch for small swellings, and 3.5 mm., or about three-sixteenths of an inch for the medium and larger ones. These cross dimensions correspond to the width of the windows made by the Nos. 3 and 4 Gruenwald punches, respectively (see Fig. 10).

The fenestration is usually placed a little eccentric, and generally toward the dependent part of the swelling.

Incision: The site for the window having been located, a transverse short incision, at right angles to the long axis of the window to be removed, and at the lower pole of it large enough to permit the entry of the punch, is now made through the skin-perichondrial layer. With a Gruenwald punch, No. 3 or 4, depending on the size of the mass, and if in doubt use the No. 4, which is the larger, and with a succession of half-bites punch out a window two-thirds to three-fourths the length of the mass. If this punch is not available mark off a curved outline of a window on the surface of the swelling of the dimensions above described with the pointed blade of a scalpel, and then with scalpel and curved scissors remove this window of skin-perichondrium *en bloc*. The contents are then expressed, and the cavity wiped out with gauze; and, if necessary, gently curetted with a Spratt's curette or other suitable instrument, and the cartilage and cavity carefully

inspected. If the cartilage is fractured loose pieces should be removed, and if there are swelling and tenderness behind the ear a window should be made through the cartilage, exposing the posterior perichondrium. The cartilage window, where necessary, is best made with the submucous knife, curette and punch. If the posterior tenderness and swelling are not marked the cartilage window need not be so large as that in the soft tissues; but if these are pronounced, and if there is

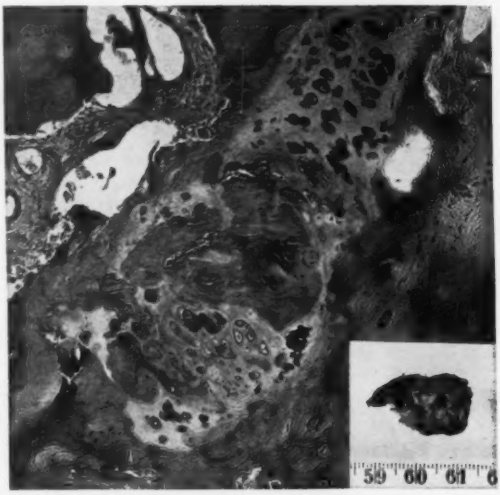

Fig. 6. Case C. W. Photomicrograph of specimen showing Dr. Ewing's findings of osteochondromatous structure. Islands of new quite typical cartilage being transformed into bone and osteoid tissue; also dilated venous spaces, etc.

Insert: Gross specimen, shriveled and reduced in size, 24 hours after removal.

definite infection present the cartilage window should be large, or better still multiple cartilage windows of medium size with cartilage columns between to preserve the contour and resiliency of the ear, and prevent the tendency to flattening which results where large windows of cartilage are removed without leaving intervening supporting columns (see Fig. 11).

In some instances I have swabbed the cavity with full-strength and half-strength iodine tincture with the object of

producing adhesions to lessen the likelihood of subsequent similar effusions developing in the same location. However, I am not convinced of the desirability or effectiveness of this measure as there is more reaction, and healing is slightly delayed, with very doubtful benefit.

Where iodine is not used, 2 per cent aqueous mercurochrome solution is instilled, or swabbed in the cavity. The surface of the ear is gently cleansed with alcohol and dried. A large, fairly thick gauze sponge, 4 inches square, is grasped at the corner with suitable dressing forceps (see Fig. 13), and sterile white petrolatum or boric acid ointment applied to the corner and edge of the gauze sponge to prevent sticking. This lubricated corner and edge of the sponge is inserted in the window to keep the edges apart, but not packed under the edges into the cavity. The remainder of the sponge is crumpled into a ball, and the gauze mass covering the outer surface of the pinna is compressed and held in position (see Fig. 14) by firm strips of zinc oxide adhesive plaster, three-eighths to half-inch wide, in fan formation with air spaces between, extending over the helix, well on to the posterior surface, but not overlapping in a way that might obstruct circulation. The first dressing should be quite snug, but subsequent ones need be only moderately so.

A mild analgesic, such as codeine half-grain, repeated if necessary, or one of the mild synthetic remedies, such as one or two allonal tablets to relieve pain when the local anesthetic wears off, may be given.

The dressing should be changed every second day, or oftener if indicated; the skin wiped with alcohol, and the wound painted with 2 per cent aqueous mercurochrome solution. A sponge with a little sterile petrolatum to prevent sticking for the first three or four dressings should be applied, after which the plain gauze sponge, without lubricant, may be used.

As the skin of the entire pinna is hypersensitive for four or five days after operation it is often desirable not to remove the adhesive from the skin, but to cut the plaster along the margin of the helix, when removing the dressing, and to place the plaster for the new dressing on top of the old strips for the first two or three dressings. After which the plaster may be removed each time when the skin is not so sensitive.

SUPPURATIVE PERICHONDRITIS.

The window operation has its supreme indication in this condition.

Traumatic hematomata of the auricle and perichondrial effusions are fairly often infected, and when infected are forms of suppurative perichondritis; but we shall now consider a few phases of this latter condition when it complicates plastic operations on the meatus, such as the radical or modified radical mastoidectomy; and from furunculosis of the meatus.

Fig. 7.

Fig. 8.

Fig. 7. Case H. B. Final result in a wrestler 18 months after the window operation. Ear is normal in every particular. No thickening, deformity or perceptible scar.

Fig. 8. Final result of hematoma auris in auricle of fighter treated by surgeon with repeated aspiration and dressings 18 years ago.

Mild swellings of the external ear coming on soon after the radical mastoid operation may result from local circulatory disturbances, or be due to dermatitis from iodine or pus bathing the tissues, or the condition may be erysipelas, in which case there may be a chill at onset, fever and rapid pulse. The thickening involves the lobule as well as the rest of the external ear and usually spreads over the face. When due to suppurative perichondritis the swelling generally appears in about 10 days after operation, accompanied by fever, marked tenderness, pain and dusky red congestion of the auricle. Both surfaces may be involved and the whole auricle except the lobule.

Treatment: Wet dressings of cold aqueous boric acid, or a 4 per cent solution of boric acid in 25 per cent alcohol, or 3 per cent aluminum acetate solution should be frequently applied until the character of the swelling is established.

Operation: If the process is one of fulminating suppurative perichondritis involving the whole auricle a hypodermic of a quarter grain of morphine sulphate, and 1-150 gr. hyoscine hydrobromide should be given 15 minutes before the operation is started. The skin is infiltrated with 0.5 per cent procain solution containing 1:50,000 adrenalin chloride until the ear is thoroughly anesthetized, or, if preferred by the surgeon, nitrous oxide-ether anesthesia may be used, but without the preliminary hypodermic.

Where the process is extensive multiple windows (see Fig. 11) should be employed. When the posterior surface is badly swollen and tender, cartilage windows should be made in front. Inflammatory edema of the skin, perichondrium, and especially of the loose areolar tissue between these structures accounts for much of the swelling behind the ear, as the fibrous trabeculae hold the posterior perichondrium quite firmly to the cartilage.

Windows: The number and location of the windows will depend on the extent, location and severity of the process. They must be adequate in size and number. Generally, the Size 4 punch should be used. When the purulent inflammation is behind the cartilage drainage is afforded by cartilage windows from in front. These had better be multiple rather than of very large size, leaving cartilage between them to preserve the shape and resiliency of the auricle.

Dressing: Following operation the dressings should be of gauze and the head bandaged as is usual with the mastoid operation. Later when the possibility of bleeding is past, if the pain and swelling continue the dressings may be kept wet with one of the previously mentioned solutions for a short time, but if the windows are adequate the relief should be prompt and definite; if not, they must be made so.

The dressings at first may be changed daily, but later less often will do. Sterile petrolatum on the gauze in contact with the wound will facilitate drainage and lessen the discomfort when the dressings are removed.

The relief is usually very prompt, and the resulting deformity and scarring either negligible or absent.

The pus is often green and frequently shows the bacillus pyocyaneus on smear and culture.

THE WINDOW OPERATION IN CHRONIC CHONDROPERICHONDRITIS; AND FOR THE REMOVAL OF OSTEOCHONDROMATOUS MASSES.

Although the window operation was primarily designed to deal with the acute fluid swellings already described, and especially to prevent absorption of cartilage, permanent thick-

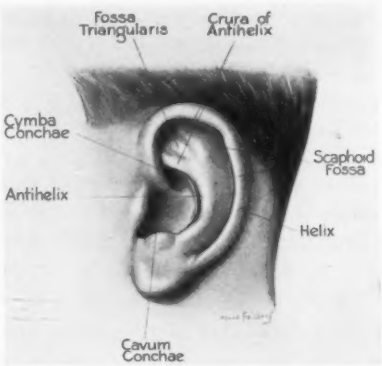

Fig. 9. White lines on auricle showing sites of election for windows where scars will be least visible, or entirely hidden from view.

Note the curved topography of the auricle with concentric curvatures centering above the tragus.

ening, deformity and scarring, the following report will show how this operation is useful in dealing with these chronic permanent thickenings resulting either from no treatment, or persisting in spite of other procedures.

C. W., a man, age 22 years, came to the Polyclinic Hospital on Jan. 29, 1934, complaining of a hard mass in the left auricle, and inability to hear on that side. He said that he had been struck on the left ear during a boxing bout a little over eight months previously, which caused a large swelling of his auricle, and nearly closed the auditory meatus.

Two days after injury his ear was aspirated by his physician and some bloody fluid removed.

The swelling remained about the same size, but it became gradually harder. He continued to box, and within the 10 days previous to admission he received blows on this ear on two different occasions that caused lacerations, and complete blockage of the left meatus, and deafness of that ear (see Fig. 4).

The thickening and deformity distressed him greatly, but the deafness necessitated relief. I decided to use the window operation to take care of infection, and as a means of removing the mass.

Removal of Osteochondromatous Mass: The routine preparation and anesthesia, as for acute cases, were employed; and the usual transverse incision, as for entry of the punch, was made. The curette end (see Fig. 12) of my submucous elevator was inserted in the incision, and the dense fibrous adhesions surrounding the bony cartilaginous mass were separated; and after completely elevating the anterior fleshy layer a window was made with the No. 4 Gruenwald punch from below upward, so as to describe an arc of a circle that would be contained in the choncha auriculae, and through this window I succeeded in encircling the mass and completely enucleating it, as illustrated in the drawing (see Fig. 12).

The specimen was very hard and bony in character. The part that came from the concha auriculae was very thick and conformed in shape to that cavity. It was this part that completely occluded the meatus. The rest of the mass tapered out thin like a fan where it had extended to the scaphoid fossa.

The mass when first removed measured 4 x 3 x 1.5 cm.

The specimen was kept in a refrigerator and the following day photographs of the gross specimen (See Fig. 6 insert) were made.

Sections of the mass were prepared, examined and reported by Dr. James Ewing as follows (see Fig. 6):

"In the case of C. W., the section from the ear shows a process which is essentially an osteochondroma. There are numerous small islands of new, quite typical cartilage which is being transformed into bone and osteoid tissue.

"There are quite a few dilated venous sinuses in the bone and in the thickened periosteum. The epithelium covering the outgrowth is broken and eroded.

"The gross description of the specimen is as follows: The material is a mass of hard bony tissue, 2 cm. long x 1 x 1 cm.

"On sawing through this mass it is found to be composed mainly of very hard bone mixed with islands of cartilage.

Fig. 10. The window operation. Showing the Gruenwald punch entering the initial incision and removing a full thickness of skin and perichondrium en bloc by a succession of half-bites to produce a uniform curved window for the evacuation of contents or the removal of subperichondrial masses and to effect drainage without the aid of any intermediary drainage material.

The overlying cuticle is eroded, and there is no sign of epithelioma. We may safely assume that this process is the result of trauma."

Following operation the patient felt no ill effects, except slight pain, which was promptly relieved by mild sedatives.

There was almost no local reaction. His hearing returned at once. The meatus has remained open. The window, which

was made very large purposely in the cavum conchae in order to contract and keep open the meatus, healed in 36 days, and the cosmetic result is excellent. The size and shape of the pinna is about normal, and the patient is well pleased.

Fig. 4 shows the patient's ear before operation, and Fig. 5 shows the ear when it is just healed.

SELECTED REFERENCES FROM THE LITERATURE.

Wittmaack states that there are no very authentic detailed pathologic, and especially histologic, studies of perichondritis of the pinna. He quotes Fischer as reporting the gonococcus, and Hang the tubercle bacillus as causes of perichondritis.

Lange discusses the often debated claim of the spontaneous degeneration origin of othematoma, especially in the aged and insane. He reaches the conclusion, long held by me, that it is difficult or impossible to rule out trauma in these cases. He points out the fact that cartilage does not contain blood vessels, against Furstner's claim of cartilage degeneration in the aged predisposing to perichondritis.

Ewing's report, and the specimen (see Fig. 6) in a case eight months after othematoma formation shows typical new cartilage, together with bone and osteoid tissue, also dilated vessels in the perichondrium. Lange (1926) pointed out that it had not been proved whether ossification, calcification or both takes place. He quotes Hoffmann as distinguishing between othematoma and cyst. In the latter, the process is slower and a connective tissue membrane forms around a fluid center.

Oertel quotes Meyer as explaining so-called spontaneous othematoma, especially in the aged, as due to chondromalacia in which are cavities filled with gelatinous material. Oertel mentions that Birkner and Brunner, also Kirchner have reported cases of othematoma due to cold or frost bite, although it is probable that the rubbing, incidentally employed here, is a big factor in the changes, as well as the freezing.

In traumatic hematoma Britton uses aspiration plus pressure exerted by copper wire, adhesive tape, plaster of Paris, collodion and combinations of these.

Butler advocates immediate incision of the acute mass, evacuation of contents and suturing of wound, with applica-

tion of modeling compound and bandage as a pressure cast dressing. During bouts he suggests a rubber bandage between rounds, also immediate suture of wound during boxing matches.

Ferguson (1933) suggests the use of a hairpin in addition to a cotton collodion cast following aspiration.

Jackson and Babcock make a curved incision, evacuate blood contents, suture with horsehair loosely; or they use a small rubber tissue drain, and then compression with a rubber sponge and bandage.

Leroux advises when the hematoma persists to make a curved incision subjacent to the helix on the external surface

Fig. 11. Schematic drawing to illustrate the placement of windows in extensive suppurative perichondritis, especially when following plastic procedures on the external ear, particularly the mastoid operation.

Note: The windows are through the cartilage to drain the inner subperichondrial space which is represented as markedly involved. Observe also the connecting columns of skin and cartilage.

of the pavilion, careful scraping of cavity, suture of lips and compressive dressing where not infected; but if there is suppuration he makes a free incision as before, scrapes the cartilage and cavity, uses a tampon of sterilized gauze, but no suture. He resects necrotic cartilage, but does not permit closure until every suspicious point is gone.

Schlitter advises repeated punctures, but when the othematoma becomes infected he employs a wide opening to prevent necrosis of cartilage. He makes transverse incisions, turning back four flaps; scoops out granulations and sutures. He leaves an opening in the center containing a medicated gauze drain.

McCoy, being impressed by the results he observed in my cases and at my suggestion, employed the window operation in two cases of suppurative perichondritis following mastoid operations, and in at least one traumatic case with most gratifying results.

Davis (1929), having dealt with these problems for more than 20 years as otologist in a large institution for the insane, and knowing the difficulties of treatment and the deformities following, was greatly impressed by the results he observed from the window method.

Almour has used the window operation in four cases; three of these were suppurative perichondritis following mastoidectomy, with results unequaled by any other method.

Kopetzky, noting results on his services and observing demonstrated patients of my series, expressed much gratification.

Scal performed the window operation on four cases of traumatic othematoma with perfect results, and he recommends it as the operative procedure of choice.

Kaiden, operating an acrobat from Dr. S. J. Kopetzky's service, with a subperichondrial serous effusion the size of a large lima bean in front of the helix in the scaphoid fossa by Darwin's tubercle, and which had been aspirated several times within a month, obtained by the window method a perfect cosmetic and functional result, without thickening, with healing in about two weeks, and a scar that could be found only with the greatest difficulty.

SELECTED CASE REPORTS.

Case 1: J. F., a colored man, age about 22 years, came to the clinic, Nov. 16, 1927, with a fluctuating swelling 1.8 cm. in diameter, located in the upper pole of the left ear, on the outer surface, and which followed a blow on the ear while boxing two weeks before. Wet compresses and leeches were applied, but the effusion remained about the same. *Operation:* Window made with Gruenwald punch on day of admission with satisfactory recovery. Collodion cotton cast was used.

Case 2: P. C., an amateur boxer, waiter by occupation, was struck on the right ear 14 days previous, with a resultant

fluid formation, 3 cm. across, in the upper outer aspect of the pavilion. Fenestration by the punch on Dec. 14, 1927, was followed by prompt relief.

Case 3: E. G. was struck on his left ear nine days before operation, which was on Jan. 16, 1929, at which time the tumefaction measured 5 cm. and was filled with straw colored fluid. A cotton collodion cast was applied, and when removed, 21 days later, there was complete healing with almost imperceptible scar formation.

Case 4: J. L., came to the clinic 19 days after he had been struck on the left ear, with an organizing hematoma auris

Fig. 12. Drawing to show how the window operation is used in the removal of tissue masses from the subperichondrial space.

The Howard submucous elevator is here employed in the enucleation of the mass.

measuring 3.5 cm. *Operation:* A large crescentic shaped window was punched out, Jan. 30, 1929, followed by excellent cosmetic result.

Case 5: F. Z. received a blow on the left ear while boxing, 13 days before admission to the clinic. The whole ear became swollen. An incision was made the night of the injury, but was followed by prompt refilling. Hot compresses and poultices were used consistently, but without material benefit.

Window Operation: Practically the whole outer surface was lifted up by the fluid formation; the external meatus was nearly occluded, and even the inner surface was tender to touch, as well as edematous. A semilunar-like fenestration,

2 cm. long, was made and the infected contents were removed very gently with the curette end of my submucous elevator (see Fig. 12). The cavity was treated with 2 per cent aqueous mercurochrome and sterile gauze was applied with adhesive strips. No collodion was used. The cartilage showed marked evidence of erosion and loss of resiliency. Following operation his condition improved, but tenderness persisted over the inner surface of the pinna; also the swelling increased, and finally, one week later, a window of cartilage was resected to give drainage through the original window to the inner or posterior cartilaginous surface. This procedure, somewhat analogous to the nasal submucous resection, was followed by rapid subsidence of symptoms, and uneventful recovery with very little deformity. The original operation was performed Feb. 15, 1929, and healing was complete 30 days later.

Case 6: A. S., a Porto Rican, age 19 years, had both ears damaged by a left-handed fighter. Window was made in each auricle, Feb. 10, 1930, which was 17 days after injury was received. Wounds healed in 15 days, with excellent results.

Case 7: P. M., an amateur boxer, age 21 years, was struck on the left ear in spite of protecting headgear in a practice bout, with resulting hematoma 3 cm. in diameter. Window operation, March 13, 1931, seven days after injury. Healing in 15 days, with a perfect result.

Case 8: J. M., a boxer, age 25 years, developed an ovoid hematoma in the upper pole of his left ear, 4 x 3 cm. in size. Window removed, June 6, 1932, three days after injury, with healing in 14 days. Iodine tincture was swabbed in the cavity to produce adhesions, and six months later he reported that the operated ear was standing up well in bouts, undamaged.

Case 9: H. B., amateur wrestler, age 26 years, developed a hematoma of the right auricle in the concha auriculae, 2 x 2.5 cm. Window made 17 days after injury, on Nov. 7, 1932, healed in 15 days, leaving no thickening or deformity and an imperceptible scar hidden under the overhanging edge of the antihelix (see Fig. 7).

Case 10: J. H., a professional wrestler, age 32 years, was hurt in a bout 12 days before operation. On admission, there was a small laceration, also a large tender fluctuating mass involving most of the external surface of the auricle, together with a tender swollen area behind the ear. On Jan. 11, 1933,

a large curved window, 2.5 cm. long, was made so that with healing the scar would be within the cavum conchae. The cartilage was found to be irregularly fractured. The loose pieces were removed and a cartilage window, to drain the posterior subperichondrial space, was made about half the length of the fleshy window. The cavity contained about 25 cc. of thin purulent fluid. He felt so fine that night, he attended a championship match. Recovery was in 14 days, and uneventful, with a perfect cosmetic result (see Fig. 3).

Fig. 13. Illustrating how a single 4-inch square sterile gauze sponge constitutes the dressing. The lubricated corner and edge of the sponge is inserted in the window. The balance of the sponge is crumpled to make a ball fitting the outer face of the pinna.

Second Injury: Just one year later, this same ear was damaged in another bout, with a resulting swelling, 3 cm. in diameter, above the former scar in the cymba conchae and triangular fossa. The former scar remained fixed and did not lift. Window operation was performed four days after injury. The opening healed in 17 days without leaving any thickening or deformity, and the scar was hidden under the inferior crus of the antihelix (see Fig. 3).

Note: The cotton collodion cast which was used in some of the earlier cases, and described in the original paper, is no longer used. It is more troublesome than the gauze adhesive

dressing (see Fig. 14) now employed. With the window operation no form of cast is necessary or desirable. In some instances they are definitely harmful.

SUMMARY.

Out of 26 cases included in this series, five were cases of suppurative perichondritis following mastoidectomy. All of these responded promptly to the window operation and none of them showed absorption of cartilage, deformity, thickening, or appreciable scarring.

The 21 remaining cases in the series were the result of trauma. In all these the window operation was employed with uniformly satisfactory results (see Figs. 3 and 7).

Of 13 acute cases, 11 were hematoma auris, and of these two were infected and nine were not infected. There were two cases of perichondritis with effusion. Of these, one was serous and the other was purulent (see Fig. 3).

The cartilage of the auricle was found fractured in five cases, and a cartilage window was made in four of these to drain the posterior subperichondrial space.

The average duration of healing was 17 days; the shortest was 14, and the longest, 30 days.

Results were slightly variable, but they were excellent in every instance.

The average age was 23 years, the youngest was 18 years, and the oldest, 30 years.

Both ears were involved in one instance; the right in four, and the left in nine.

Wrestlers numbered four, and boxers numbered nine. Of these latter, six were professionals and the remaining three were amateurs.

The swellings were mostly oval in shape; about one-fifth less in width than in length. The shortest was 2 cm.; the longest, 5 cm., and the average, 3.4 cm.

Treatment previous to operation was in one instance leeches; two used ice, and two heat; lotions and wet dressings

by two patients, and six had either no treatment, or what they did use is unknown.

All were males.

INDICATIONS.

Since permanent thickening or absorption of cartilage seems to follow in nearly all cases when untreated, or are treated by other measures or procedures, it is well to operate within two to four days of the injury.

When suppuration is present immediate operation becomes mandatory.

Fig. 14. The fan-shaped dressing. Sketch showing the radiating arrangement of adhesive tape to keep the gauze compactly in place. Air spaces are left between the strips which extend to the inner surface.

The window operation appears to be the method of election for the removal of acute and chronic swellings involving the cartilage and perichondrium of the auricle.

Suppurative perichondritis, especially following radical mastoid operations, is the supreme urgent indication for this operation.

CONTRAINDICATIONS.

Hemophilia apparently is the only absolute contraindication for this operative procedure, except lack of positive indica-

tions, such as possibly where the mass is small, shows a tendency to rapidly regress, or is hidden where it will not be noticeable; as for example, deep in the cymba conchae under the crus helicis.

RESULTS.

No appreciable permanent thickening, deformity or scarring has followed in any of the known acute cases where this operation has been used.

The chronic cases have been greatly improved in function and in looks.

We have not seen a patient who was dissatisfied with the results following the window operation.

The procedure, as far as demonstrated, has proved simple in principle and execution, with results that are uniformly satisfactory to both patients and surgeon.

CONCLUSIONS.

The method of removing a piece of tissue, consisting of perichondrium and a full thickness of skin, by means of a punch or other suitable cutting instruments, and thus producing a window with prompt evacuation of contents and free drainage, appears to be established as a satisfactory way of dealing with these hematomata, fluid formations and chronic masses between the perichondrium and cartilage of the auricle.

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THE AMERICAN BOARD OF OTOLARYNGOLOGY.

During 1935, examinations will be held in New York City, June 8, in connection with the meeting of the American Medical Association, and in Cincinnati in the Fall, during the meeting of the American Academy of Ophthalmology and Otolaryngology. Prospective applicants for certificate should address the Secretary, Dr. W. P. Wherry, 1500 Medical Arts building, Omaha, Neb., for application blanks.

OTOMYCOSIS IN HAWAII.*

DR. CLARENCE W. TREXLER, Honolulu, T. H.

The role played by fungi as pathogens for man is of serious import to a far greater degree than is generally recognized. This may become manifest orally, as in Vincent's angina, between the toes, as in epidermophytosis, in the external auditory canal, as an aspergillosis, or elsewhere on or in the body under various nomenclature. More recently we have it brought to our attention locally of the lowly yeast fungus doing damage, and this saccharomycosis invading internal organs with avidity—even fatally. The same holds true with coccidiodes immitis cases.

We know that practically every organ may become invaded by fungi, but, since they are believed to be so eclipsed by bacteria in amount of damage they do, we have unjustly consigned them too far into the attic of discards. It is my intention to discuss the part played by these fungi, not generally, but chiefly as clinical manifestations in the ear, at the same time noting my limitations as a mycologist, being fully cognizant that competent mycologists are a rarity.

This statement is made not in the light of criticism, but with the appreciation that mycology covers a large field, in sufficient scope and importance to require all the attention one could give it. The exact number of cases in Hawaii probably will never be determined, but a conservative estimate leads me to estimate a total of 50,000 to 100,000 in the Territory at the present time, in which definite damage is being done upon the genus *homo sapiens*.

Otomycosis: Here we have the name and address of fungi causing ear pathology. We have yet to determine the exact damage done by this group and it is probably due to lack of this exact knowledge that we have not considered fungi as more unfriendly invaders, as we lend our ears as hosts. But now, as public spirited citizens have been awakened to the

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cause of the deaf in Hawaii, contributing to the fund to provide the so-called "radio ears," it behooves the medical profession, as a unit, to determine what may contribute toward this deafness and to quickly eradicate the cause. We have been harping for a long while upon tonsil and adenoid removal, nasal and accessory sinus therapy, together with general hygiene. We have gone far but we probably have overlooked a not infrequent contributory cause of deafness in the tropics —that of fungus infestation of the ears.

Mycotic pathologic processes in many cases are not recognized; in some, ill-defined, and in still others, probably berated regarding the amount of pathology produced.

These have no respect for age or class, as they occur in individuals where best hygiene is known. Sailors as a group seem predisposed. In reality, it is usual to find the condition confined to the skin of the external auditory canal, more commonly in those having many coarse hairs at the external auditory meatus, probably acting as predisposers by mechanically obstructing fungi from making their exit.

The number of otomycosis cases seen and diagnosed by the microscope is a large one, probably 100 cases having come for therapy during the past two years; the number being, to a large extent, augmented by those coming to Palama Settlement Clinics.

The type most frequently found to invade the external ear is that of the aspergillus in its general forms, as nidulans, flavus, niger and fumigatus. Some have proved to be of other varieties, as furfur, mucor and penicillum. As we here are primarily interested in the clinical aspect, the classification should be left to the mycologist.

The fungi are seen to have ramifying filaments called hyphae, which form an intricate network called mycelia. Some are seen to have branches which may dig between the epithelial cells in securing a foothold, especially when excoriation has been caused by penetration by fingernails, hair pins and the like. Too, there are often spores, which, resistant to treatment, prove a bulwark against destruction by ordinary forms of medication.

Following pruritis or forcible attempts at extraction of cerumen, mycelial threads gain entrance, passing from on-

lookers to do battle. In 10 cases coming for therapy there were perforations of the tympanic membranes, in which the patients denied having had previous signs or symptoms of otitis media — far too large a number to be regarded as purely incidental. In each case the drum membrane appeared gray and thickened, and the sensitivity was markedly decreased. May we not, in such cases, regard it highly probable that the symbiosis (fungi plus bacteria) worked quietly to effect this change? Riggall[1] in a recent article states: "The presence of the Vincent's spirochete also increases the pathogenicity of other organisms." Hence deleterious effects of fungi at once assume a role of impelling interest and importance.

The complaints registered are more of discomfort than distress, and the majority report patiently waiting for the ears to refrain from feeling of "stuffiness." Too, the unusually rapid accumulation of a doughy mass, oftentimes in a few days after thorough removal, is a frequent complaint. The pain is negligible, but if one ear is stopped up head noises are frequently complained of, and when the patient speaks he often hears his own voice best in the affected ear, though actually the acuity of hearing is often slightly decreased in that ear. It is not infrequent that pressure is exerted upon the drum, both by the fungi, which proliferate abundantly, and also by the patient in attempted removal. Also the practice of instilling various oils has been enjoyed by the fungi, whose growth is thereby accelerated, thereby defeating the purpose intended. The public should receive instruction of this danger.

As stated, the fungi appear often as a sodden waxy mass, which may form a complete cast of the external auditory meatus and may resemble a foreign body or inspissated cerumen. There is little likelihood of mistaking the mass for anything else. It is conceivable that fungi may invade the middle ear and the Eustachian tube and thereby gain entrance to cause oral mycosis or even antral mycosis.

Partial removal of the fungi is a simple procedure, usually accomplished by syringing the ear, or this may be materially aided by suction. Spores and mycelial threads must be removed by medication.

Diagnosis may be evident from the finding. But the microscope clinches the diagnosis after material has been sub-

jected to 10 per cent NaOH solution and immediately examined. Or a drop of Giemsa stain is quickly taken up by the fungi and may aid in diagnosis microscopically. Other methods are used but need not be discussed here.

Fungi readily succumb to proper medication. After removal by irrigation, a 1 or 2 per cent salicylic acid in alcohol daily syringing for a week and repeated at intervals for two months, has been very satisfactory. Ragle,[2] who has directed treatment of a large number of service men with mycotic infestation, has had excellent results by using 2 to 4 per cent thymol in castor oil applied in lieu of the salicylic acid alcohol. A saturated solution of sodium thiosulphate also is an efficacious remedy. One authority[3] contends that Americans spend only 1 per cent of their time in diagnosis and 99 per cent in therapy, while the opposite holds true in certain European centres.

RESUMÉ.

1. Otomycosis is a relatively frequent finding in the tropics.

2. The amount of pathology it produces has not yet been determined.

3. Evidence presented makes it appear that fungi play a more important part in disease of the middle ear than is generally recognized, thereby contributing to deafness.

4. Otomycosis is recognized clinically and microscopically, and readily lends itself to well directed therapy.

5. The practice of the laity in inserting hair pins and fingernails in the ears is admitted to be a vicious one, but no less so than indiscriminately pouring oil into the external auditory meatus.

6. The problem of eradication should be taken care of by the medical practitioners as a group and more painstaking efforts seem fully warranted.

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HYDROSTATIC IONIZATION OF THE NOSE.

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In 1929, while experimenting with the effect of infrared rays upon vasomotor rhinitis and allergic conditions of the nose, I was led to try the ionization treatment of the above conditions. It was manifest at once that the method of treatment was in many respects inadequate. In the first place, many patients had deviated septums, which made it next to impossible to place the tampons, soaked with ionizing fluid, in the nose. Secondly, the placing of tampons in the nose in sensitive patients necessitated cocainizing the mucosa first, which in turn was a procedure to be avoided for best results. No matter how gently tampons may be inserted into an uncocainized nose the procedure is not a satisfying one either to the doctor or to the patient.

From the viewpoint of efficacy of treatment, this fact is unalterable, only that mucosa which is in contact with the ionizing solution will receive the ionizing effects. Mechanically because of the physical construction of the nose with the overhanging turbinates, the deep crevices of the meati, and the narrowness of the superior regions of the nose, tampons do not reach the entire mucosa. That reported results have been good with the above methods simply proves the efficacy of a treatment, in spite of its inadequacy of application.

It was very apparent from the onset that only by filling the nasal cavities with fluid could the physical obstructions be overcome, and at the same time the entire nasal mucosa would receive the ionizing effects.

My first endeavors in this direction were primitive, consisting of putting a posterior choanal plug into the nose, similar to those used in controlling nasal hemorrhage. The head was held back while the nose was filled with ionizing solution. The patients subjected to this objected. It appeared that the treatment was as bad, if not worse, than the disease. However, the results were good.

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The next step was simple, the posterior choanal packs were eliminated. The patient lay on a couch with his head hanging over the end, so that the top of the head faced the floor. Now, by filling the nasal cavity with fluid, the posterior nasopharynx and the nasal cavities were flooded. Holding the mouth open, the patient breathed slowly and deeply. It was indeed surprising to note that after the first treatment, the position and treatment was not hard to bear. Once again on the cases of vasomotor rhinitis, chronic nasal catarrh and allergic conditions, the results were surprisingly good.

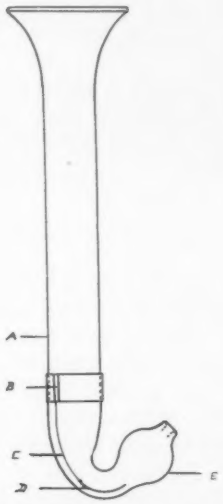

Fig. 1. (A) Glass tube; (B) copper band around glass tube; (C) platinum wire connecting copper band with (D) zinc electrode; (E) nasal tip.

About one year later, I thought it might be a good idea to give an ionizing treatment while slowly irrigating the nose. For this purpose, I used an ordinary rubber tube having a nasal tip. The tube was filled with solution, the nasal tip inserted into the nose, and then the tube was elevated to about the level of the top of the head. Hydrostatic pressure of the solution in the tube caused the fluid to circulate through the nose. The positive pole of the electrode was inserted into the open end of the tube, while the patient held a pad con-

nected with the negative pole in the hand. The surprising fact resulted, that whereas I had expected most of the fluid to run out of the mouth, and relatively little through the other nostril, the opposite occurred; only a little fluid escaped through the mouth, while most ran through the opposite nostril. On investigating this, I noticed that as soon as the solution entering the nose touched the posterior nasopharynx, the soft palate elevated itself in a sort of protective mechanism, thus acting as a barrier to the fluid entering the throat, and facilitating its passage into the opposite nostril. From that point the present technique was evolved, which is highly satisfactory, enabling a patient without discomfort to have the nasal cavities filled with ionizing solution, and a treatment to be given very simply.

The apparatus used is a glass tube about 7½ inches long, having a nasal tip coming from the tube at an angle. A sealed-in electrode, at the base of the tube, simplifies the electrical connections.

METHOD OF APPLICATION.

The patient is seated with the head only slightly inclined forward. The nasal tip is inserted into one nostril, sufficiently snug to prevent leakage. The positive pole of the galvanic apparatus is connected with the sealed-in electrode at the base of the tube, while the patient holds in one hand a moistened pad connected with the negative electrode. The top of the tube is funnel-shaped and through it the ionizing solution is slowly poured. Since the top of the glass tube is above the level of the nose, the solution in the nose will rise to the same level it occupies in the tube. In this way the entire nasal cavity will be flooded. As the fluid touches the nasopharynx the soft palate is automatically raised and the solution begins to escape from the opposite nostril. At this point, the patient occludes the opposite nostril, and we have the entire nose filled with ionizing solution, and ionization already taking place, as electrical contact has been made. The patient holds the mouth open and breathes deeply. There will be some slight escape of solution from the throat, which is readily made up by pouring more solution into the funnel to keep it at the proper level. One per cent zinc sulphate solution is used.

Duration of treatment is about 10 to 20 minutes, using approximately 6 to 10 milliamperes of current.

In looking through the literature, I could find no reference to this method of ionization, although I feel sure that there must be many men, who, like myself, have in years past used similar methods to the above.

This ionizing apparatus has been made for me by the Eimer & Amend Co., of New York.

The sealed-in electrode is made of zinc, and in my experience can be used indefinitely, when applied for medical purposes. The act of ionization only detaches from the electrode, electrical charges, called electrons, and otherwise does not affect it.

My results obtained in allergic conditions of the nose and chronic catarrhs have been very good, but are not presented here as the purpose of this paper is solely the description of the hydrostatic method of ionization.

40 West 86th Street.

CHRONIC SINUSITIS IN CHILDREN. DIAGNOSIS AND TREATMENT. CASE REPORTS.*

DR. WILLIAM SPIELBERG, New York.

The frequent incidence of chronic accessory sinus suppuration in children is today conceded even by the most conservative in the medical profession. The relationship of sinusitis to acute and chronic aural suppuration and its complications, to keratitis, orbital cellulitis; to systemic complications, such as chronic bronchitis, bronchiectasis, asthma, gastrointestinal disturbances and secondary complications of nephritis, arthritis, chorea, anemia, cardiac lesions, is today well known and understood.

However, in spite of our indisputable knowledge concerning the above facts, there seems to be an utter disregard, not only on the part of the general practitioner, but even the pediatrician, to take the subject of sinusitis in children seriously and to establish proper treatment and care once the condition has been recognized. It further seems that the physician, in his zeal and determination to exterminate the tonsil and adenoid, has entirely overlooked the possibility that his little patient may have a sinus infection, associated with or entirely independent of the tonsils and adenoids.

The appalling slaughter of tonsils in children during the summer months in private practice and hospitals, as well as in teaching institutions, with utter disregard as to the presence of a coexisting sinus infection speaks for itself.

In this paper the author wishes to point out the relationship that frequently exists in children between chronic accessory sinus suppuration and diseased tonsils and adenoids, and to call attention to the common disregard for symptoms which clearly point to the presence of sinusitis but which latter are attributed to infected tonsils and adenoids only. Short reference will also be made to our method of X-ray diagnosis, and the method of procedure followed in the treatment of these cases. A few case reports have been selected as illus-

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trations in order to emphasize some of the more important phases of the subject in question.

It is our hope that the recording of our experiences may be of some benefit and that others having made similar observations may contribute additional information of value.

From observation of cases in my private and hospital practice, I have found that a great number of cases referred to me with a diagnosis of diseased tonsils and adenoids, showed the presence of an undiagnosed chronic sinus involvement. The latter existed either as a complication of the infected tonsils and adenoids or as an independent condition.

History: The age of the children observed ran between two months and 14 years. The symptoms complained of were tabulated as follows:

1. The child had been suffering from very frequent or perpetual nasal colds and profuse nasal discharge and mouth breathing ever since the mother could remember.

2. Upon advice of a physician many had their tonsils and adenoids removed; some had been operated on more than once; some had their antrums punctured and washed during or subsequent to the tonsillectomy.

3. No relief followed the operation. Patient always felt worse. Nasal colds, discharge and obstruction were aggravated. On complaint to their doctor, the latter said that the child would "outgrow the condition."

4. One or more attacks of acute otitis media was a very common complaint. Many had frequent spontaneous ear discharge. Others had to have their ears lanced prior to and after a tonsillectomy had been done. In some, ears were always discharging. A great number had mastoidectomies, of whom many had two or more operations each for recurrent mastoiditis.

5. Others gave a history of diurnal eneuresis, restlessness at night, gastrointestinal disturbances, malnutrition, asthma, bronchitis, nephritis, pyelitis, anemia, chorea and cardiac lesions.

EXAMINATION.

1. Nose: The rhinoscopic examination presented a very interesting and characteristic picture found in all cases examined.

The anterior portion of the inferior turbinate was markedly turgescent, frequently impinging on the septum and bathed in yellowish mucus, mucopus or very thick pus, thin and stringy in others.

On shrinking the inferior turbinates with adrenalin, the entire floor of the nose was found completely covered with secretion and dripping posteriorly into the pharynx. Various grades of hypertrophy of the mucosa of the inferior and middle turbinates were found; polypi were not seen. Several cases of vasomotor rhinitis were noted, and many showed early or advanced atrophic changes of the nasal structure without ozena.

2. Throat: Tonsils and adenoids were usually found to have been removed. When present they were hypertrophied and diseased. A postnasal drip of thick yellow or greenish mucopus was invariably present. Granulation tissue, hypertrophy of the posterior pillars with follicular degenerative changes were usually present.

3. Ears: The otoscopic examination varied from a somewhat sclerotic retracted drum to one having a small mucous perforation, or a large marginal perforation, to absence of one or both drums and ossicles. The hearing was usually poor, particularly when the ears were filled with thick discharge. An occasional case of unilateral deafness was found. Many have had unilateral and bilateral mastoidectomies done.

DIAGNOSIS.

1. Suction: To complete the examination and to obtain a better idea as to the quantity of the discharge present, its source and characteristic appearance, suction was used in the following manner: The nasal discharge was sucked into a small suction bottle partly filled with water to which was attached a straight metal cannula and suction obtained by a Sorenson pump. By means of this cannula every part of the nose, floor, inferior and middle meati and posterior nares could be separately investigated. The pus was sucked into

the water in the suction bottle and could be seen as either small flocculent masses, stringy mucous or as very large casts of pus. If one is careful not to hurt the patient, very little difficulty will be found in applying this method of suction. In children hard to manage, a small piece of rubber tubing was attached to the end of the suction cannula to prevent traumatizing the nasal mucosa.

On shrinking the inferior turbinates and removing the pus by suction, the patient was able in each instance, to the surprise and gratification of the mother, to blow the nose and breathe freely and clearly as never before.

It was rather surprising to find that many of these children did not know how to blow their nose and, as a matter of fact, have never before been seen by the parent to blow the nose.

2. X-ray: X-ray in the nasal sinuses is indispensable in children as well as in adults. It is one of the most important aids in the diagnosis and outlining of the course of treatment to be followed. When properly taken and interpreted, the X-ray plate always gives the rhinologist the information he seeks. Too much emphasis cannot be made on the necessity of the rhinologist to learn to interpret his X-ray pictures and to have the pictures taken always by the same individual. It has been my custom for many years, when a patient consults me for nasal trouble, to have X-rays taken by the same X-ray man and read the plates myself. It has been my sad experience to find the average plate brought me by the patient to be poor and frequently useless. Very few X-ray men appear to know much about the interpretation of sinus plates. The X-ray examination in most instances showed clouding of both antra with evidences of pathologic changes in the mucosa lining the antra. No cases of involvement of the frontal or sphenoid sinuses were found and but few instances of ethmoiditis were seen. In the X-ray studies three positions were taken:

1. Anteroposterior (occipitofrontal), one view.
2. Bitemporal (lateral), one view.
3. Oblique position of Rhese, right and left.

The anteroposterior position is taken with the nose and forehead on the plate. This position gives us most informa-

tion, since a comparative study of all sinuses except sphenoids may be made. Particularly is this view important in children whose antra are most frequently the seat of pathology with all other sinuses fairly normal.

The lateral or bitemporal position is taken of either the right or left. This view is particularly useful in the study of depth of the sphenoid and frontal sinuses when operation interference is under consideration.

The oblique position of Rhese is in my opinion the most valuable in studying the ethmoid sinus and its relation to the frontal sphenoid, optic foramen, anterior cranial fossae, etc. Limitation of space will not permit a more detailed discussion of this very valuable position.

3. Antroscopy of maxillary sinuses is the most valuable aid in the diagnosis of maxillary sinusitis. It is most reliable and gives more information than the X-ray plate. For diagnostic purposes it is used less in children, because one hesitates to puncture the antrum of a child much more than of an adult for obvious reasons. It should, however, be done preliminary to a nasoantral resection, to determine the exact pathology of the lining of the mucosa of an antrum. This can be done at the time the antrum is punctured. An antrum filled with thick pus, new bone (osteoma), gelatinous matter, a large dentigerous cyst, an extensively hyperplastic mucosa, will frequently give one and the same shadow. An antroscopic examination will tell the story.

4. Transillumination in my opinion is not worth much in doubtful cases, and is useless in children.

Treatment: A diagnosis of nasal accessory sinus suppuration was made on these patients and a course of treatment outlined. Two forms of treatment were employed: *1.* Palliative; *2.* Surgical.

1. Palliative treatment was given in every case and was considered as a trial treatment, to be followed by surgical treatment in case the former failed. It consisted of suction and argyrol tampons.

a. Suction: A few words may be said here in reference to the method of suction employed in the treatment of these children. I have found the open or topical method of suction

the most beneficial, particularly in sinus work of this type. By this method one can completely clear the nares of residual pus without causing traumatism by strong and continuous negative pressure of the nasal fossae and all sinuses. The latter frequently causes excessive engorgement of the nasal mucosa to the point of bleeding, headache and marked obstruction to respiration. Children treated in this latter fashion become unmanageable and respond poorly to treatment, frequently causing the parent to become discouraged and abandon treatment. Two methods of suction are employed.

In older children and in children that are less irritable, the nasal discharge is removed with a straight large-calibred pliable mettle cannula attached to a small suction bottle. It is very important at first, before sucking the pus from the nasal chambers, to swab carefully but quickly the nasal mucosa with a 1-1000 adrenalin solution on a fluffy cotton swab, employing a mettle applicator. When shrinkage has occurred the cannula is slowly introduced into each nasal chamber, proceeding along the floor all the way posterior to the epipharynx. On completing the nasal suction, the cannula is introduced into the epipharynx through the mouth, right in back of the uvula, raising the soft palate and removing all pus that might be found dripping down into the hypopharynx.

If slight negative pressure in both the nasal fossae is desired in order to bring out secretions from the interior of a sinus, the operator can close both nostrils while the tube is in the nose. We can thus very often on inspection, locate the sinus involved by the location of the pus. The latter is subsequently sucked through the cannula into the bottle. The procedure is repeated several times until the nose is cleared of all secretions.

In infants and more irritable children, a soft thin rubber catheter is used to remove all nasal discharge. The catheter is connected directly to the suction tube of the pump and introduced into each nasal chamber, pushing it into the epi and hypopharynx, thus clearing up all secretion from both the nose and throat at one time. This method is so satisfactory and beneficial that the writer attributes the good results obtained by him, in the treatment of sinusitis in children, mostly to this procedure. It is painless, does not traumatize, never causes nasal bleeding, does not cause negative pressure

on any of the nasal tissues and completely and efficiently removes all nasal discharge. If done gradually and slowly at first, children submit to it and at times even enjoy the procedure. The type of rubber catheter used is a No. 13 French scale. An additional opening is cut away in the catheter somewhat above and on the opposite side of the one present. This enables the catheter to suck up secretions from two different surfaces at the same time.

b. Argyrol Tampons: After thorough shrinkage and removal of all secretions as above described, argyrol tampons were introduced in each naris, according to the Dowling technique. A 10 per cent solution of argyrol (two parts and one part of glycerine) warmed to body temperature was used. Tampons were left in for 15 minutes to a half hour. The mother was taught the art of nasal tamponage and instructed to use it twice daily. She was encouraged to instruct the child in the proper use of the handkerchief. The latter I consider very essential in the cure, as noted above, most children do not know how to blow the nose properly, if at all, thus allowing an accumulation of pus in the nares with resulting ear complication through Eustachian tube extension when the child coughs or sneezes.

A thorough medical examination by the family physician and correction of diet and hygiene was advised.

c. Irrigation: Irrigation of the antrum through the natural orifice was frequently resorted to in children whose X-ray findings indicated the presence of an empyema or residual pus in the antrum. It was found most valuable, frequently clearing up a case that responded to no other form of treatment. A case of protracted antrum suppuration should not be subjected to surgery unless a thorough trial had first been given this method of antral lavage. In all infants and in the majority of young children, it was not necessary to employ surgical treatment. Suction, argyrol tampons, lavage and general medical care cured the patient.

d. Vaccine Therapy: In 54 patients, autogenous vaccines were used. Cultures were taken from the nose and throat, and vaccines prepared by Dr. Hadjopoulos, Bacteriologist at the Beth Israel Hospital. In a personal communication, Dr. Hadjopoulos states the following:

"In my experience, the use of autogenous vaccines has shown more satisfactory results than that of a casual stock vaccine of unknown source and origin. The additional knowledge obtained by the bacteriological study of suspected foci is of prime importance, especially when we compare focal flora before and after vaccinotherapy.

"It is surprising to see how certain strains disappear after a course of vaccine treatment while some individual strains, especially of the encapsulated, coccic and bacillary forms, resist even to a heroic vaccine therapy.

"Thus vaccinotherapy has been a valuable guide for surgical intervention in rhinolaryngology.

"The pernicious practice of dosing large quantities of heat-killed vaccines should be stopped if one expects to gain the confidence of the patient for a relatively long course of treatment. Shock doses usually kill the aim of vaccine treatment right at the start by reducing individual resistance (anaphylactic period), prolonging recuperation and rendering patients miserable, thus forcing them either to quit the physician or stop vaccines completely.

"Any chronic, long-standing disease has already developed a sort of specific bacterial protein sensitiveness from continued focal absorption. The aim of vaccinotherapy in such cases is primarily to desensitize the patient's cellular mechanism and then build up a very gradual immunity towards the harmful invader. With these principles in mind, the use of minute doses of very weak but specific vaccines is of paramount importance."

Method of Preparing Vaccine: Cultures of all suspected foci, such as discharge from sinuses, granulating sinus walls, tonsillar crypts, inflamed nasopharyngeal mucosa, etc., are taken by means of either swabs, straight platinum point or loop and individually inoculated into nutrient glocuse broths. These are incubated from eight to 12 hours, and agar pour plates are prepared for the identification and isolation of the various flora. Streptococcus hemolyticus, streptococcus viridans, pneumococcus, staphylococcus aureus, B. coli, pneumobacillus are considered pathogenic. Their relative preponderance is noticed which determines their proportionate representation in the vaccine mixture.

After isolating the representative strains, they are once more inoculated in ten cc. of nutrient glucose broth and incubated from 24 to 48 hours. At the end of this incubation the tubes are centrifugalized under aseptic precautions and the supernatant clear broth separated from the sediment.

The sediment is then suspended in ten cc. of 1 per cent carbolized saline and left at room temperature for three days. A loopful of this is then tested for sterility. If no living bacteria are present, the tubes are centrifuged once more until all bacterial cells are completely thrown to the bottom. The final vaccine is prepared by drawing in a tuberculin syringe 0.10 cc. of the clear supernatant fluid which represents the specific carbohydrate fraction of bacteria and mixing this in ten cc. of a 0.5 per cent (one-half of 1 per cent) carbolized saline. If more than one strain goes into the vaccine, the total amount of 0.10 cc. is made up by using such portions of each strain as represented originally in the pour plate.

Thus we have a hundredth normal vaccine (carbohydrate filtrate), the initial dose of which is 0.01 cc. The administration of such small doses is facilitated by filling a tuberculin syringe of one cc. divided into hundredths, up to 0.50 cc. with sodium cacodylate, and on top of this drawing from the vaccine bottle 0.01 cc.

The injections are given intramuscularly, preferably the deltoid, and only once a week. Doses are increased very cautiously, never going over 0.05 cc. Any loss of weight or increase of the general symptoms is considered a reaction. If this occurs with the initial dose of 0.01 cc., the vaccine should be diluted ten times to represent a 1/1000 normal dilution. If there is any reaction in the course of increasing doses, such doses should be reduced by half until the patient acquires sufficient tolerance.

With these precautions, specific vaccinotherapy has been a great help in the management of rhinolaryngological cases and a good number of unwarranted surgical intervention avoided.

Following the use of these vaccines in 54 patients, I feel much encouraged as regards to the value of vaccine therapy in chronic sinusitis as compared to other types of vaccines

previously used. Particularly in children is this form of vaccine therapy worth a trial. Out of the 54 cases treated with vaccine, ten were operated on and vaccine used postoperative. Four (40 per cent) were cured; four (40 per cent) improved; one (10 per cent) unchanged or worse; one (10 per cent) showed no change. Forty-four cases received treatment as previously outlined and vaccine as an additional measure. Twenty-two cases (50 per cent) were cured; 18 cases (40 per cent) were improved, and four cases (1 per cent) were unchanged.

The writer feels that the results obtained in the 44 cases that were treated nonsurgically were greatly influenced by the vaccine as compared to a great many other cases treated without vaccines. The cases treated surgically were all of the very extreme type with infection of long standing accompanied by complications, such as repeated ear and throat infections, mastoiditis (recurrent), cervical suppurative adenitis, laryngitis and previous sinus surgery. Whether or not the vaccine therapy was of any value in the latter group cannot be stated with any degree of certainty. More work and research along these lines is necessary to determine whether or not surgical treatment in children could be entirely avoided.

2. Surgical Treatment: a. Endonasal antrotomy or resection of the lower nasoantral wall when pathology was confined to antra only. *b.* Endonasal pansinus operation in cases where ethmoids, frontals and antra were involved, or only the ethmoids and antra. *c.* Transantral ethmoidectomy —where endonasal approach to the ethmoids was impossible due to marked narrowing of, or very small nasal passages.

a. Endonasal antrotomy consisted of puncturing one or both antra involved and resection of the inferior meatal wall. Argyrol tampons, suction and autogenous vaccine in combination with general medical care, were used postoperatively.

The success of the surgical treatment depended invariably upon the size of the fenestrum made in the nasoantral wall and upon the length of time it remained open. In no case has the treatment failed where the opening was very large and remained patent for three months or more. It was the large opening made to drain and aerate the sinus that cured the sinusitis.

Following the puncture of an antrum the latter was never washed, for reasons to be discussed later. In case of an acute exacerbation during treatment, it was thought best to leave the sinus alone until the acute attack subsided.

Operative Procedure: The successful outcome of the operation depends upon two factors: *1.* Anesthesia. *2.* Visibility of the field of operation.

Anesthesia: The anesthesia to be used is of paramount importance. Upon it depends the success and outcome of the operation. In children that are not easily managed, as the very young, or those who are naturally restless, general anesthesia is preferable. In older children, from eight to 14 years, local anesthesia is more desirable.

a. General Anesthesia: When a general anesthetic is used the inferior meatus is always packed with cotton pledgets moistened in 1/1000 solution of adrenalin hydrochloride as a preliminary to the operation. This is done either before or during the administration of the anesthesia. The packing is placed in the inferior meatus tight up against and over the whole inferior turbinate and along the floor of the nose. This procedure is found essential in cases where general anesthesia is used in order to produce a bloodless field of operation.

b. Local Anesthesia: When administered, the lower nasal fossae is swabbed first with 5 per cent cocaine and adrenalin 1/1000 equal parts and followed by tight packing of cotton in the same solution, as outlined above.

In both local and general anesthesias, the packing is removed after 10-15 minutes, or longer if possible.

Visibility of the Field of Operation: Direct vision and a bloodless field of operation are essential and are dependent upon one another. Without either, a thorough resection of the nasoantral wall is very difficult and frequently impossible. Those of us who have done this work in children, especially under general anesthesia, know how free and profuse hemorrhage will interfere with the operation. Bleeding worries the surgeon, causes him to hurry and be less thorough in his work. In order, therefore, to operate under direct vision a bloodless field is necessary. This is brought about by adrenalin packing in the inferior meatus as outlined above, both in the local and

general cases. It saves time, loss of blood and insures a successful result. When general anesthesia is used a postnasal plug is always inserted before the operation is begun.

Instruments: The author's straight trochar and cannula or the chisel are used in puncturing the sinus. The latter have many advantages over the curved trochar and cannula. When desired, the author's antroscope can be inserted through the cannula and the antrum carefully inspected before proceeding with the enlargement of the opening. The straight trochar is very easily handled and apt to cause less traumatism than the curved type of instrument. The straight West chisel curved back has been found the best when a trochar was not used.

Operative Technique: Before the operation is begun the packing is removed, making sure that all the pieces of cotton are out.

a. By means of a straight separator or a long nasal speculum, the inferior turbinate is infracted upwards as far as possible in order to bring the nasoantral wall into full view. Care should be used not to cause bleeding through traumatization of the mucosa.

b. With a full view of the anterior two-thirds of the inferior nasoantral wall, the latter is punctured with the trochar or straight gauge. After inspecting the antrum with the antroscope, the antrum is sucked clear of any contents, such as pus, mucus or gelatinous material. The opening is then enlarged by swaying the trochar or the chisel.

c. By means of a Jensen punch forceps or a strong Gruenwald punch, the opening is still further enlarged by resecting a large portion of the nasal antral wall. The entire procedure can be done under direct vision and without any bleeding.

d. The lower and anterior portion of the nasoantral wall is rasped out by means of a Wiener antrum rasp, a curette or a Watson William frontal sinus rasp. A direct view can now be had of the interior of the antral cavity. It is surprising how much may be seen of the antrum and its contents, even in children.

e. The inferior meatus is then packed with iodoform vaseline gauze and the inferior turbinate placed back in its former position, thus holding the packing in place.

Postoperative Treatment: The iodoform gauze packing is left in for two or three days, or longer, depending on whether or not postoperative bleeding is expected. If bleeding is feared, it can positively be prevented by allowing the packing to remain for as long as one desires. More will be said about this in the discussion of postoperative hemorrhage. When the packing has been removed, the problem of treatment is simply confined to keeping the nose, throat and antrum clean of secretions. Topical suction by cannulae or rubber catheter is used, both for nose and throat and antrum. The cannula or tube can easily be introduced into the antrum through the antrotomy made and all debris and secretions removed. This is followed up by argyrol tampons, using 10 per cent argyrol mixed with glycerine (one part glycerine to two parts argyrol), warmed and left in the sinuses for a half hour or longer if possible. Radiant heat light or the infra-red lamp has been found beneficial. Zinc ionization of the antral cavity (postoperative) was used in a few stubborn cases with noticeable improvement. In long standing cases the patient or parent is instructed to use the tampons at home once or twice a day.

b. The endonasal pansinus operation was done in older children who had an involvement of other sinuses besides the antra and where other nonsurgical means of treatment have failed over a long period of time, *i.e.*, one to two years, or when repeated attacks of ethmoiditis occurred, accompanied by general systemic disturbances.

Operative Procedure: The technique followed in the above procedure was also used here to include the ethmoids labyrinth and in a few instances the frontals. An anterior ethmoidectomy was done after dislocating the middle turbinate toward the septum and the nasofrontal passage located and enlarged with a frontal sinus rasp to admit freely a No. 1 or No. 2 sound. The field of operation was always packed with iodoform vaselined gauze to prevent postoperative hemorrhage and removed in three to four days.

c. The transantral ethmoidectomy was resorted to only when due to the extreme narrowness of the nasal passages it was impossible to introduce instruments into the nose to enable the operator a field of visibility. The following technique was employed:

1. After inducing anesthesia an incision is made through the labiogingival fold, exposing the anterior antral surface.

2. A small opening is first made into the antrum and subsequently enlarged upward to the lower orbital ridge working around the infraorbital canal and nerve.

3. Proceeding upward enough nasal process of the superior maxilla is removed with rongeurs to expose well the upper inner angle of the antrum formed by the floor or ethmoidal overhang.

4. The antral contents are inspected and properly taken care of.

5. The mucosa covering the ethmoidal overhang is stripped, thereby exposing the bony ethmoidal floor.

6. With a small Gruenwald punch the ethmoids are then resected from below, beginning posteriorly in order to avoid getting into the orbital cavity.

7. The sphenoidal sinus is easily explorable through this route.

8. Counter openings are then made through the middle and inferior meati into the nasal chambers.

9. The ethmoids and antrum are packed with vaselined iodoform gauze.

10. Incision is closed with silk sutures.

Packing is removed in five to six days. Postoperative treatment is the same as above.

Postoperative Complications: Postoperative complications are infrequent, but should be guarded against. Proper care during and after the operation will prevent complications. Of the latter to be considered, two are most worthy of attention: *a.* hemorrhage, and *b.* otitis media.

a. Hemorrhage: Postoperative bleeding is usually very slight and hemorrhage rare. When it does occur it is due to bleeding from the nasal branch of the sphenopalatine artery running along the posterior and lower nasoantral wall; one should be careful not to take too large a bite when resecting the posterior lower portion of the nasoantral wall; if the bony

canal where the artery runs is opened distinct squirting synchronous with the heartbeat will be seen at the time. Postoperative bleeding can then be anticipated by stopping the squirter with either bone wax or compressing the bleeder by chiseling into it, followed by tight packing with gauze and allowing it to remain *in situ* five to six days postoperative.

If not all, I would say that most cases of postoperative nasal hemorrhages are due to too early removal of nasal packing. Nasal packing may be left in indefinitely without complications provided one knows that there is packing in the nose. By placing the packing well forward in the inferior meatus

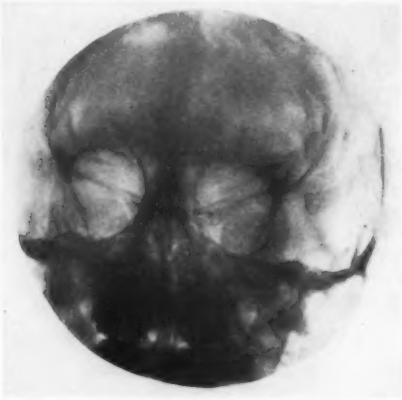

Fig. 2. X-ray of sinuses. Anteroposterior view.

and away from the mouth of the Eustachian tube, infection to the middle ear can be prevented. Concerning the relationship between prolonged nasal packing and meningitis, I will say that I have never seen a case of meningitis caused by nasal packing. I have personally removed packing left in the nose for two and three months with no meningeal symptoms. If one has injured the dura during the operation, a meningitis will ensue whether one packs the nose or not. The maxim is, no injury to the dura during the operative procedure, no meningitis. If one has injured the sphenopalatine artery or any of its branches, either on the sphenoidal wall or lower nasoantral wall or the nasal artery on the septum, or

has opened large ethmoidal blood vessels, he must pack the nose and keep it packed until the packing literally falls out, if he wishes to prevent serious postoperative hemorrhage. In the past three and four years I have practiced this procedure of packing and have had no postoperative bleeding at all. Whereas, previously I have had many sleepless nights and much aggravation and heartache caused by the frequent occurrence of postoperative hemorrhage.

b. Acute Otitis Media: Acute suppurative otitis media may follow prolonged nasal packing, particularly if postnasal plugs are used. By placing the nasal packing tightly in the inferior meatus, well forward and under the inferior turbinate, keeping it away from the mouth of the Eustachian tube, no ear complication will occur. I do not recollect having had any. When no bleeding is found or expected, the packing is removed in 24 to 48 hours. If postnasal plugs are used to stop postnasal hemorrhage, remove them within 24 hours and reintroduce fresh plugs if bleeding recurs.

REPORT OF CASES.

Case 1: J. T., age 6 years. First examination on June 17, 1929.

History: Tonsils and adenoids removed two and one-half years ago for the relief of frequent nasal colds and attacks of otitis media. Following the operation the nasal discharge became more profuse and colds more frequent. Soon after he developed bilateral O. M. P. A. with mastoiditis and had a double mastoidectomy performed. However, the condition previously complained of persisted with resulting reinfection of his mastoids ten months later, and was reoperated. Patient was brought to me in order to ascertain the cause of his recurrent attacks of mastoiditis and to attempt some form of treatment that might prevent similar occurrences.

Examination: Rhinoscopic examination revealed the presence of a chronic suppurative sinusitis. Turbinates were markedly turgescent and bathing in pus; both nares were completely filled with pus. *Throat:* Profuse postnasal drip of purulent secretion. Tonsils removed. *Ears:* Bilateral O. M. P. C. with profuse mucopurulent discharge from both middle ears. Large marginal perforations bilaterally. Large postauricular scars. *X-ray:* X-ray examination showed marked

cloudiness of both antrums, suggesting an exudate in both, with moderate clouding of both ethmoids. *Operation:* On Jan. 18, 1930, a bilateral resection of the nasoantral walls was done under general anesthesia. Antra were found filled with pus, polypi and granulations. Postoperative treatment consisted of suction, argyrol tampons, etc.

At the last examination, Oct. 29, 1932, the patient has not had any recurrence of ear trouble since the operation. Nasal cavities are dry and general improvement in the entire physical condition of the child. Patient has had only occasional nasal discharge which subsided in a few days from the onset.

Patient is still under observation, although considered cured.

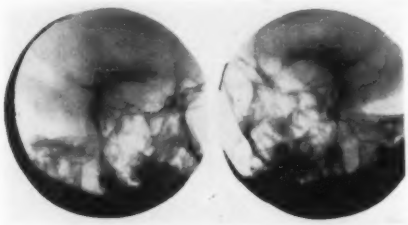

Fig. 3. X-ray of sinuses. Lateral or bitemporal view.

Case 2: H. D., age 7 years. First examination, June 21, 1929.

History: Nasal obstruction with frequent nasal colds and profuse discharge since birth. At age 3 years, tonsils and adenoids were removed at the advice of the family physician. Symptoms were aggravated and patient began to get very frequent attacks of purulent otitis. Three years ago he was operated on double mastoiditis, followed again a year and a half later by recurrence of same and was operated on the second time. Patient still gets severe nasal colds with discharge and obstruction.

Examination: Rhinoscopic examination showed the presence of chronic suppurative sinusitis. Nasal fossae filled with profuse purulent discharge. Marked congestion of mucous membrane of turbinates. *Throat:* Postnasal drip of pus,

stumps of tonsils in pharynx. *Ears:* Bilateral O. M. P. C. with large marginal perforations. *X-ray:* X-ray examination showed marked involvement of both antra with moderate clouding of the ethmoids.

Operation: On Jan. 8, 1930, a bilateral intranasal resection of the nasoantral wall was performed. Antra were filled with pus and large amount of granulations. Postoperative treatment was given as above outlined. At the last examination, July 11, 1932, patient has not had any recurrent ear discharge, only an occasional exacerbation of his sinus condition, which cleared up promptly without any complications.

Comment: No preoperative treatments were given in the above two cases. Due to the history and physical findings, it was thought not advisable to waste any more time to treat these patients palliatively.

Case 3: D. K., age 2 years. First examination, March 5, 1928.

History: Tonsils and adenoids operated previous winter for relief of nasal discharge and colds and frequent attacks of ear trouble. Condition became worse after removal of tonsils and adenoids so that the child was unable to sleep at night. Had marked loss of appetite with resulting loss in weight and health. Examination revealed a marked suppuration of the nasal sinuses. Due to the age of the patient, treatments were given for five months as outlined in this paper, but with very little or no improvement.

X-ray examination during this period of treatment showed marked involvement of both antra. On April 2, 1930, both antra were opened by resecting the nasoantral wall under general anesthesia. Advanced polypoid degeneration of the antral mucosa was found with the sinuses filled with pus. On the last examination, May 21, 1932, the child has made considerable progress in general health and growth, but still gets frequent attacks of purulent infections of the nasal sinuses. The present attacks are, however, much shorter in duration and do not impair the child's respiration and health to the same degree as previous to the operation. Patient is still under treatment.

Case 4: M. P., male, age 22 months.

History: Has a constant nasal discharge. Mouth breather. Discharge from right ear for one month. Very restless at night and is runing a temperature 102-103°.

Examination: Nares completely blocked with thick pus. Engorged inferior turbinates. *Ears:* Left purulent otitis with profuse thick discharge. R. O. M. P. A. with bulging of drum in posts. sup. quadrant. No mastoid tenderness. *Throat:* Postnasal discharge. Hypertrophied diseased tonsils and adenoids.

Treatment: A paracentesis was performed on right ear and pus under pressure evacuated. Nasal condition was treated for several weeks, but without improvement. Puncture and irrigation of the infected maxillary antra was advised, but was refused by mother of patient. Treatments were therefore given during the next three months. At the end of this period child was able to breathe freely and comfortably through the nose; nasal discharge was still present, but very little; ears had completely cleared up with no other attacks. At this time the removal of the tonsils and adenoids was considered appropriate and were removed under general anesthesia. Following the operation, the patient kept on improving. At the last examination, both ears were dry, nose free from any secretions, nasal breathing established, general health of patient very much improved.

Comment: In this case where tonsils were still present, the sinuses were cleared up first and tonsillectomy performed later, without any aggravation of the sinus infection; in fact, it helped to clear up the sinus condition quickly. A much quicker result could have been obtained had consent been given for surgical treatment of the antra. However, this case shows what can be accomplished with patience and perserverance in following a given course of treatment when nothing more radical can be done either due to the condition of the patient not permitting it or the refusal on the part of the patient to undergo a prescribed form of treatment.

Case 5: F. R., male, age 6 years. First examination, March 29, 1932.

History: For five years had frequent nose and chest colds, bronchitis. Tonsils and adenoids removed three years ago. Worse since operation.

Examination: Nose: Moderate nasal atrophy and mucopus in nares.

Case 9: M. M., male, age 6 years. Nasal colds and discharge, with many attacks of otitis media since birth. Treated one year. Operated and treated year and one-half—vaccine therapy. Not cured. Ocsasional periods of remission.

History: Ever since birth has running nose, obstruction to respiration, colds, bronchitis. Is weak, underweight and underdeveloped. Had many attacks of O. M. P. A. with paracentesis. At age 2 years had tonsils and adenoids removed and felt worse ever since.

Fig. 4. X-ray of sinuses. Oblique position of rhese.

Examination: Nose: Chronic hypertrophic changes with nares filled with very thick greenish inspissated pus. Moderate atrophy. *Throat:* Tonsils out. Post drip and granular pharyngitis. *Ear:* Bilateral atrophic and retracted drums. *X-ray:* X-ray showed marked clouding of both antra and ethmoids.

Treatment: On April 1, 1931, following of about one year of palliative treatment, an endonasal operation was done under general anesthesia with resection of lower nasoantral wall of both sides. Antra found filled with massive granulation tissue, polypi and pus. As much as possible of the contents was removed at operation. Postoperative treatment was given,

including vaccine. At times patient was improved. Exacerbation frequently occurred and nose was almost always filled with pus. Additional surgery was suggested, but refused by parents. Last seen on Oct. 15, 1932, nose still discharging pus. Post drip of pus. His general condition has somewhat improved, but the condition of his antrums remain the same, although openings in the lower antral wall are still patent.

Case 10: C. G., male, age 9 years. Chronic nasal discharge since birth. Repeated ear abscesses. Right endaural mastoidectomy with recurrent attacks. Treatment of sinuses; cured.

History: Examined July 21, 1932. Ever since mother can remember the patient has nasal discharge, frequent colds and running of ears. Five years previous to this examination, had right endaural mastoidectomy. Ear cleared up for a while and discharge recurred with temperature and general illness. After staying well for three years, tonsils and adenoids were removed to cure the nasal colds. Condition was aggravated and right mastoid began to discharge through the external canal. Discharge was of a foul odor. Nose blocked and profuse pus discharge and post drip.

Examination: Nose: Deflected septum to right. Nares rather roomy and filled with pus and crusts. dripping posteriorly into the epipharynx. *Ears:* Left, normal; right, drum intact, sclerotic and retracted, post canal wall almost completely absent with large opening exposing large mastoid cavity filled with pus and granulations and areas of bare spongy bone, of mucosa or granulation tissue. Pus has intense foul odor.

Treatment: Consisted of immediate care of the sinus infection. A vaccine was also prepared from the nose, throat and ear discharge and given. The mastoid cavity was cleansed daily for a long time and kept dry. Sulzberger powder was used. After five months both the nose and ear were cleared up. No operative work was done. At the last examination, July 12, 1933, patient was found normal. Both ear and nose dry. Discharged cured.

General Comment: As a result of his work in this connection, the author is prompted to stress the need for greater diligence and care in the examination and treatment of chil-

dren suffering with diseased tonsils and adenoids since many are frequently affected with an accompanying sinusitis.

In this connection it is important to point out the need not only for greater thoroughness in examination of cases referred for tonsillectomy, but also an attentiveness to the history given by the parents which invariably gives clues of an existing sinusitis.

Throat: Tonsils out. Marked post drip of pus. *Ears:* Negative.

Treatment: Removal of nasal discharge by suction, etc., argyrol tampons and vaccine therapy. Rapid improvement. Last examination April 19, 1933, patient discharged cured. Has been free from colds and coughs. Nose dry, appears less roomy than previously.

Case 6: T. H., male, age 6½ years. Nasal obstruction, constant nasal discharge and colds. Treatments and vaccine. Cured.

History: Examined April 4, 1932. Tonsils and adenoids removed 1½ years ago. Colds worse since then, blows constantly and uses many handkerchiefs daily.

Examination: Nose, chronic hypertrophic rhinitis and suppurative sinusitis. *Throat:* Post drip of pus. *Ears:* Negative.

Treatment: As outlined and vaccines. Last examined July 28, 1932, patient discharged cured.

Case 7: B. C., male, age 9 years. Constant nasal colds and profuse discharge. Ear abscess. Treated with vaccine. Cured.

History: Examined Dec. 23, 1931. Tonsils and adenoids removed six years ago. Feels worse since. Abscessed ear four years ago. Frequent earaches.

Examination: Nose: Chronic hypertrophic suppurative sinusitis, profuse purulent discharge filling up nares. *Throat:* Profuse postnasal drip. *Ear:* R. O. M. P. A.

Treatment: Ear cleared up under conservative treatment. Nose treated and vaccine administered. Discharged cured April 24, 1932.

Case 8: B. G., male, age 14 years. Began with pain in upper teeth. Constant nasal colds and profuse discharge. Multiple nasal operations. Radical bilateral transantral operation. Cured.

History: Examined Jan. 12, 1930. For three months pain in upper teeth. Had left intranasal antrum opening made at some clinic. Has profuse nasal discharge of pus and recently has pain in forehead. Expectorates large amounts of pus.

Examination: Nose: Nares filled with thick profuse purulent discharge. No evidences of an opening in either antrum. Nasal fossae wide and atrophic. Pus coming from ethmofrontal region bilaterally. *Throat:* Atrophic, post drip of pus and crusts in hypopharynx. *Ears:* Negative. *X-ray:* Showed marked involvement of all the sinuses.

Treatment: On June 25, 1930, a bilateral intranasal pansinus operation was done at the Beth Israel Hospital. Following the operation and with continuous treatment, patient improved. After about one year of treatment and follow up care, it was found that recurrences and colds were very frequent. Nasal discharge very profuse at times with some severe acute exacerbations. Although the antra were wide open, they kept up discharging pus very profuse, with no recession in the pathologic state of its mucosal lining as checked up by X-ray and antroscopy. On Feb. 20, 1931, a bilateral radical antrum and transantral ethmoidectomy was performed. With subsequent treatment and follow up care the patient was discharged greatly improved Dec. 15, 1931. Examination April 30, 1932, showed a fairly clear nose and sinus condition, with very little or no discomfort to patient. Although remarkably improved, the patient is not considered completely cured and is still under observation.

CONCLUSIONS.

1. In children, nasal accessory sinusitis is very frequently associated with diseased tonsils and adenoids, although one may exist independently of the other.

2. The preliminary removal of tonsils and adenoids in the presence of a chronic sinus infection in children, particularly when associated with nasal atrophy is counterindicated. The procedure seems to aggravate the infection and protract the

course of the disease. The operation may be of benefit only when the sinus infection has been cured or greatly improved.

3. Contrary to popular belief, sinusitis in children is very common, beginning sometimes at birth and due to exposure or aspiration of infected material into the nasal passages during delivery.

4. Pathologically two types of sinusitis are recognized, the hypertrophic and atrophic. The recognition of either form is essential as a guide in determining the form and course of treatment to be followed.

5. The hypertrophic type of sinusitis responds better and more quickly to both palliative and surgical treatment as compared to the atrophic form. Atrophic sinusitis is frequently incurable. All cases can, however, be improved by palliative measures. Surgery is not advised in atrophic sinusitis; it invariably makes the condition worse.

6. Nasal sinusitis in children can be completely cured if recognized early and prompt and effective treatment instituted.

7. A so-called slight cold or running nose in a child should be regarded not as a rhinitis or coryza, etc., but as rhinosinusitis. The rhinitis is always associated with a similar process in the mucosa of the sinuses.

8. Radical operations are unnecessary and should be avoided in young children. In older children and in very stubborn neglected cases when associated with ear complication, surgery of a conservative type is frequently necessary.

9. As a prophylactic measure in the prevention of nasal sinusitis, children should be taught how to properly blow the nose and use the handkerchief. Correction in hygiene and diet and the removal of sources of infection are other important facts to remember.

10. Autogenous vaccine therapy is strongly recommended.

235 East 22nd Street.

EDEMA OF THE RETINA DUE TO ACUTE MAXILLARY SINUSITIS.*

DR. HENRY DINTENFASS, Philadelphia.

This case is presented because of its rarity. Involvement of the ethmoid, sphenoid and, occasionally, the frontal sinus has been responsible for pathologic changes in the eye with resultant disturbances in vision, but pathologic eye changes due to maxillary sinus disease are extremely uncommon.

H. A., male, white, age 30 years, developed a head cold on Christmas day. For the next few weeks, despite treatment, the condition grew worse. On Jan. 12, he complained of severe pain over the left side of the face, eye and head. Believing that a left upper molar, which contained a small cavity, was responsible for his trouble, he consulted a dentist, who extracted the tooth. Following the extraction, his suffering became so intense that he was unable to sleep, notwithstanding the administration of large doses of morphine. On Jan. 16, he noticed blurring of vision of the left eye and was sent to Dr. Lehrfeld by his family physician for an eye examination. The eye findings were as follows: "Edema of the upper and lower lids with some ecchymosis beneath the skin of the lower lid. Tenderness over the eyeball. Tenderness over the upper and inner angle of the orbit at the attachment of the pulley of the superior oblique (Ewing's sign). Sluggishness of the left orbicularis muscle. Lagging behind of the left eye on convergence. Edema of the retina in the macular region. Vision in the right eye was 5/6. In the left eye, vision was 5/6 partly; letters could be seen but they were blurred and distorted (metamorphopsia)."

After the eye examination, he was referred to me for examination of the sinuses. There was extreme tenderness and some swelling of the tissues over the left maxillary antrum. The mucosa of both nares was quite red but no pus was apparent. The septum was straight and the turbinate bones

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appeared normal in size and contour. The tonsils were hypertrophied and showed evidences of infection. Transillumination revealed complete cloudiness over the left maxillary sinus. The right antrum was clear, as were also both frontals. The X-ray demonstrated also that the pathology was confined to the left antrum, the other sinuses being unaffected. The temperature was 102° F.

Because of the intensity of the patient's suffering and the increasing dimness of vision in the left eye, it was deemed advisable to puncture the left antrum without delay. Accordingly, a Lichwich needle was inserted under the left inferior turbinate in the usual manner and pushed into the antral cavity. A profuse discharge of pus under very great pressure immediately followed. The needle was permitted to remain *in situ* for over one hour the patient lying on his healthy side while the purulent drainage continued. Improvement was evident at once. The pain over the left antrum became less and the eye discomfort and the headache diminished. The antrum puncture was repeated daily with gradual alleviation of all the symptoms. On one occasion lavage was also attempted but proved so painful that the procedure was not tried again. At the end of the first week the edema of the lids had practically disappeared and although the patient was conscious of a heavy feeling on moving the left eyeball pain and tenderness were absent. The antral punctures were continued every other day, the secretion from the sinus becoming less profuse and more serous in nature. On Feb. 1, two weeks after the acute symptoms developed, the retinal edema had entirely subsided, the vision had returned to normal and the maxillary antrum was free of pathology.

The route of infection from the diseased maxillary antrum to the eye may be through various pathways. First, extension of the acute inflammatory process by contiguity; second, invasion of the toxins from the infected antrum to the retina by the venous route; third, pathologic changes due to obstruction of lymph. Judging from the immediate improvement following the antral puncture, it would appear that the extension by contiguity was the etiologic factor in the causation of the eye affection.

1305 Spruce Street.

INTESTINAL BACTERIAL FLORA IN CHRONIC SINUS DISEASE.

DR. SIDNEY N. PARKINSON, Oakland, Cal.

Certain clinical experience in the past few years has seemed to the writer to suggest something of interest to those engaged in treating infections of the sinuses, at least to those who recognize in sinus disease a frequent cause of general toxemia with its many and varied symptoms. Evidence is offered that may be considered suggestive of the role of the intestinal tract in producing such toxemia, the intestinal pathology being apparently secondary to, and dependent upon, infection in the nasal chambers and accessory sinus cavities That systemic symptoms do occur from chronic sinus infection is generally admitted, although between rather wide limits as to the frequency. The conditions commonly mentioned include arthritis, carditis, nephritis, gastrointestinal disturbances, deafness, malnutrition, malaise, etc.[1,2]

To this list of conditions I would add fatigability as perhaps the most common of all, occasionally it being the chief complaint and usually accompanying whatever other symptoms there may be. The dependence of general symptoms upon infection in the sinuses has often seemed demonstrated by the marked relief following eradication or control of that infection. In fact, it is difficult to see how this relationship could reasonably be doubted. The following cases appear to illustrate this:

Case A.: Miss V. C., nurse, age 23 years, was first seen Oct. 4, 1932. She complained of purulent nasal and postnasal discharge of more than five years' duration, prolonged colds, frequent frontal headaches, cough and poor appetite. She had had muscular and joint pains on and off for four years, and had long had a feeling of constant tiredness. Her day's work unduly fatigued her and sleep seemed never to bring rest. Her family physician had found nothing sig-

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nificant except her nasal infection to account for this. She had had sinus treatments for several years, and one year before had had large surgical windows made in both antra, with many subsequent washings. All this, she said, without evidence of either local or general relief.

Examination revealed large surgical windows in both antra, and no gross retention was demonstrated in either of these sinuses, but the nasal mucosa was smeared with mucopus. Probing indicated grossly thickened antrum membrane, as did also radiographs. There was much nasal congestion.

Oct. 28, 1932, the membranous lining of both maxillary sinuses was exenterated and was found to average about one-quarter inch in thickness, with small polyps throughout. Cultures of the diseased membrane showed a pure growth of hemolytic streptococci.

By Nov. 9, less than two weeks postoperative, the patient said she felt better and stronger than at any time for many months. Improvement in all symptoms continued. When last seen, 18 months after operation, she reported that she had remained well, both from local and systemic complaints, and felt quite normal.

Case B.: L. O., physician, age 57 years, consulted me Feb. 24, 1933. Patient complained of joint pains on and off for four years, especially in fingers and mandible, and was anxious to know if a focus of infection could be found. Other complaints included lack of energy and strength, frequent frontal and parietal headaches, marked constipation and local symptoms of nasal congestion and some crusting in the nostrils. Various kinds of treatment had been tried without success.

Congestion and some stringy mucopus were found in the nose, and radiographs showed slight cloudiness of all the sinuses, especially the ethmoids. Cultures from the nasal fossae showed a predominance of staph. aureus hemolyticus, plus a slight growth of strep. viridans. Cultures from the rectal mucosa showed staph. aureus hemolyticus. Treatment was started a month later, March 29, with an antigen prepared from the cultures, in an attempt to develop im-

munity to these particular organisms, also a specific bacteriophage was given orally, and local nasal treatment was instituted.

Within one week the constipation was entirely relieved, and within two weeks there was a moderate improvement in the rheumatic symptoms. By the end of the month, April 28, the rheumatic pains had entirely disappeared, and at last report, Sept. 5, 1933, had not returned. There had been continued relief from constipation, fewer headaches and marked improvement in general well-being and strength.

Case C.: Miss C. M., nurse, age 31 years, first seen July 26, 1932. Patient complained of nasal and postnasal discharge of many years duration with frequent maxillary and supraorbital headaches, and rather frequent severe colds accompanied by cough. There had been frequent joint pains for eight or ten years, but no deformity. Fatigability had become progressively important during the past few years. Surgical windows had been made in both antra six years before, with many subsequent sinus irrigations and other treatments, but there had been no improvement in either local or general symptoms.

The nasal mucosa appeared moderately congested and lusterless, and somewhat smeared with pus apparently from the middle meatus. Large antrum windows were found. Tonsils were absent. Radiographs of the sinuses showed definite pathology in both antra.

On Sept. 3, 1932, the membranous lining of both maxillary sinuses was removed. The postoperative course was satisfactory. Improvement in general health as well as in local symptoms was very prompt and by the end of a month, the patient stated she felt entirely well. At last report, April, 1934, a year and a half after operation, the patient stated she was still in excellent health. She had remained entirely free from rheumatic pains, headache, cough and nasal purulent discharge; fatigability gone.

Cases A and C are typical of many I have seen where surgical antrum windows have been made and much subsequent sinus washing done without benefit. The prize example is

that of a man whose operation had been done ten years before, and whose frequent irrigations were estimated to have totalled over fifteen hundred, without apparent effect, either locally or systemically. These cases obtained prompt relief after extirpation of the diseased sinus tissue. Surgical antrum windows have a useful place in the care of sinusitis, but it is a mistake to consider them a cure-all. If this were so the management of sinusitis would be reduced to such simple terms that no special training whatever would be needed in this field.

If dependent drainage were all that is required to cure chronic infection in an antrum, such examples as the foregoing would not exist. The local pathology would clear up and systemic symptoms dependent on the infection would disappear. But this is not always the case. Too often, drainage of bacteria-laden mucopus continues uneffected, and the mechanism of toxin absorption, suggested further on in this paper, continues unchanged.

Opinions on the actual mechanism of toxin absorption in sinus infection are seldom seen in the current literature. My impression is that it is generally assumed that toxic manifestations of such infection are based on the passage of toxins directly through the sinus and nasal mucosa into the lymphatic channels or into the blood stream. That such direct absorption occurs to some extent can scarcely be denied, but that it is an avenue of importance is, I believe, open to question.[3,4,5] Consideration of the physiology and function of sinus and nasal mucosa would logically lead us away from this local area, and cause us to search elsewhere for the zone of absorption. In fact, the very scantiness of evidence of any considerable local absorption acts as a comfort to those who are skeptical about the importance of sinus disease in focal infection.

The suggestion that distant areas may be important from the standpoint of toxic absorption is occasionally seen in recent literature. Fenton[6] has stated his opinion that absorption through the sinus mucosa is "relatively slight," and that the sinuses "act as reservoirs of infective material which passes down into the respiratory and digestive tracts and is elsewhere absorbed."

It has been well demonstrated by many workers that the chief protective mechanism of the upper respiratory tract is physical and mechanical through ciliary activity.[7] The protective nasal secretions are not antiseptic, and lymphatic drainage is probably meager.[3] Nature's line of defense consists very largely of an extensive and highly efficient mechanical cleansing apparatus which is constantly sweeping material out of the sinuses and out of the nose. The path of ciliary drainage is from the sinuses to the nasal fossae, thence along the walls of the pharynx and hypopharynx to the mouth of the esophagus.[8] There the material, unless expectorated, is swallowed.

It seems reasonable that infectious material thus swallowed must at times pass through the stomach and small intestine without sterilization. Postnasal material when swallowed is highly mucoid, a condition which would tend to protect the enmeshed bacteria from gastric digestion, and such drainage is constant and its ingestion takes place throughout the 24 hours, whereas obviously the quantity and concentration of digestive secretions in the stomach vary greatly, at certain hours being almost negligible. And it is conceivable that on reaching the lower ilium and large bowel, pathogenic bacteria would find conditions favorable for growth and implantation in the bowel mucosa. This concept is in agreement with that of Traut,[9] in discussing the passage of mouth organisms through the stomach.

In the presence of a sustained paranasal sinus infection, one might expect then, that from repeated bacterial dosage through swallowing postnasal mucopus, there would occur bacterial growth in the intestinal tract of the identical pathogenic strains found in the infected sinuses. Such a growth over a wide area should logically result in considerable production of toxins, the absorption of which might well give rise to general manifestations of infection.

The relationship of otitis media to intestinal infection in infants[10] has been well established, and for years our attention has been called to the intestinal complications of throat infection.[11] More recently the relationship of oral infection to ulcerative colitis[12] seems to have been demonstrated. Traut[8] and others, studying cases of chronic arthritis, have found

that streptococci cultured from the rectum have been very similar to the streptococci cultured from the mouths of the same patients. The purpose of this communication is to offer suggestive evidence that intestinal infection may result directly from infection in the sinuses and may be of primary importance in the cause of general symptoms of toxemia. In a sense it would seem that consideration of the intestinal tract as a factor in the toxemia of sinus infection has been neglected, perhaps because it appears so very obvious.

During the past two years, in conjunction with several medical confreres and with Prof. Albert Krueger, of the Department of Bacteriology of the University of California, a study has been made of the nasal and bacterial flora of 24 cases of chronic sinus infection, in which no other sources of infection were evident. Besides these, Dr. Krueger[13] has similar records of many more cases from other sources. The plan of obtaining rectal as well as nasal cultures, and the concept of the probable relationship of nasal to intestinal bacterial flora, were suggested by Dr. Krueger, and all bacteriologic work reported was done by him. It was our purpose to determine a basis for treatment with an autogenous bacterial antigen, which it was hoped would aid in controlling systemic symtoms.

Cultures were made in each case from the middle meatus of each nasal fossa, and from the rectal mucosa. The rectal culture was taken in each case by an internist or by the family physician in the following way: after several cleansing enemas, the clean rectal mucosa was well exposed through a proctoscope and the surface then brushed with a sterile swab, the idea being to obtain a culture from the mucosa with a minimum of contamination of B. coli.

The following tables show the pathogenic bacteria found in the nasal and rectal cultures of these 24 cases of chronic sinus infection (general but not local symptoms are indicated in each case):

TABLE.

Case	Symptoms	Nasal Cultures	Rectal Cultures
1	Headache Fatigability	Strep. viridans Staph. aureus	Strep. viridans Strep. hemolyticus
2	Arthritis Colitis Fatigability	Staph. aureus hemolyticus	Staph. aureus hemolyticus
3	Arthritis Fatigability	Strep. hemolyticus Staph. aureus	Strep. hemolyticus
4	Arthritis Fatigability	Staph. aureus hemolyticus	Staph. aureus hemolyticus
5	Colitis Fatigability	Strep. viridans B. pyocyaneus Hemophilic	Strep. viridans
6	Fatigability	Strep. hemolyticus Strep. viridans	Strep. hemolyticus
7	Neuritis Fatigability	Strep. viridans Strep. hemolyticus	Strep. viridans
8	Vertigo	Staph. aureus hemolyticus Strep. hemolyticus	Staph. aureus hemolyticus
9	Rheumatism	Staph. aureus hemolyticus	Staph. aureus hemolyticus
10	Hypertension	Strep. viridans Strep. alpha prime hem. Strep. hemolyticus	Strep. viridans Strep. alpha prime hem. Strep. hemolyticus
11	Fatigability Colitis	Staph. aureus Strep. (non-hemolytic)	Staph. aureus Strep. hemolyticus Strep. viridans
12	Rheumatism Fatigability Colitis	Strep. viridans Staph. aureus hemolyticus	Strep. viridans
13	Arthritis	Strep. (non-hemolytic) Staph. aureus hemolyticus	Strep. (non-hemolytic) Strep. viridans
14	Arthritis	Strep. viridans Staph. aureus	Strep. viridans Staph. aureus hemolyticus
15	Arthritis Fatigability Constipation	Staph. aureus hemolyticus Strep. viridans	Staph. aureus hemolyticus
16	Asthma Fatigability	Strep. hemolyticus Hem. microerophile	Strep. hemolyticus
17	Arthritis Fatigability	Strep. viridans Staph. aureus hemolyticus	Strep. viridans
18	Arthritis	Staph. aureus hemolyticus	Staph. aureus hemolyticus
19	Arthritis	Staph. aureus hemolyticus Strep. viridans Strep. hemolyticus	Staph. aureus hemolyticus
20	Arthritis Fatigability	Strep. viridans Strep. alpha prime hem. Hem. gram neg. rods	Strep. viridans Strep. alpha prime hem.
21	Arthritis Fatigability	Staph. aureus hemolyticus Hem. gram neg. rods	Staph. aureus hemolyticus Strep. alpha prime hem.
22	Arthritis	Strep. alpha prime hem. Strep. viridans Staph. aureus hemolyticus	Strep. alpha prime hem. Strep. (non-hemolytic)
23	Arthritis Fatigability	Staph. aureus hemolyticus Strep. hemolyticus	Staph. aureus hemolyticus Strep. hemolyticus Strep. alpha prime hem.
24	Rheumatism Fatigability	Staph. aureus hemolyticus Strep. hemolyticus	Staph. aureus hemolyticus

It is seen that the nasal and rectal cultures do not perfectly coincide in all cases. Nevertheless, the similarity in cultures appears too great to be merely incidental. The report covers all cases so investigated and in each it appears significant that at least one pathogen is common to both cultures, and in some several apparently identical strains appear. Moreover, in a number of seemingly normal controls* investigated by Dr. Krueger, very few showed pathogenic bacteria in the rectal cultures, even though some were found to be present in the nasal cultures.[13] Similarly, Traut and Herrold[14] found streptococci much more commonly in the rectal mucosa of arthritic patients than in apparently normal controls.

In general, the nasal pathogens listed coincide with other culture studies made elsewhere.[15] Similarly, the rectal cultures agree approximately with those reported by Traut,[8] and by Streicher and Kaplan[16] in patients with arthritis and colitis.

The frequency of occurrence of the various pathogens of this series is as follows, the significant item being the last column showing those instances where the organism was found in both nasal and rectal cultures simultaneouslv:

Organism	Nasal	Rectal	Both
Staph. aureus	4	1	1
Staph. aureus hemolyticus	14	12	12
Strep. viridans	12	10	9
Strep. hemolyticus	8	8	5
Strep. (non-hemolytic)	2	2	1
Strep. alpha prime hem	3	5	3
B. pyocyaneous	1		
Hem. gram. neg. rods	2		
Hem. microerophile	1		

Summary: A report is given of 24 cases of sinus infection, all apparently chronic, showing concurrently general manifestations of toxemia. In each case it was believed that the sinuses harbored infection generally defined as focal.

*Undergraduates of the University of California.

Cultures of nasal and rectal bacterial flora were made from each patient. There is apparently a more than casual similarity in the pathogens grown from these two areas in each case.

These findings seem to suggest that intestinal infection may occur secondary to infection of the paranasal sinuses and may play an important part in the production of the toxemia of sinus disease.

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Medical Building.

SOME CLINICAL OBSERVATIONS ON THE INFLUENCE OF CERTAIN HYGROSCOPIC AGENTS IN CIGARETTES.

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The effect of cigarettes on the health of the smoker has been discussed from many angles and generally the evidence depends on the attitude of the person making the observations. So many factors enter into the picture that it is almost impossible to eliminate the personal element in such a study. The symptoms which one may be studying may have been the result of some other exposure rather than that of smoking. It is hard to get absolute objective symptoms that cannot be attributed to some other pathologic conditions. Furthermore, in a study of the effect of smoking on the mucous membrane of the nose and throat there is no scale by which one can express the degree of congestion. One must depend on personal impressions and one cannot carry these impressions with exactitude to another examination a week later. In other words, one cannot take the tissue and compare it in a colorimeter with a known standard so that it can be expressed in terms that will correspond to the determinations made by another observer.

The study presented in this paper was suggested by the work of Mulinos and Osborne,[1] who have demonstrated in a definite manner that the combustion products of tobacco containing glycerine as a hygroscopic agent will cause an irritation of the conjunctival mucous membrane when instilled into the conjunctival sac of rabbits. They also found that the same tobacco mixture containing no hygroscopic agent would cause an irritation, while tobacco containing diethylene glycol had only a slight and momentary action.

The various disturbances which have been associated with cigarette smoking are as follows: Excess salivation; hoarseness; irritation and "biting" of tongue; cough; shortness of breath; burning; palpitation of the heart.

All these disturbances with the exception of palpitation of the heart are associated with an irritation of the mucous membrane.

The conditions under which a cigarette is smoked will change the hazard and it is difficult to know on what product, or combination of products, one should throw the blame for the symptoms noted. The following are among the many products which have been found to be present in tobacco smoke: Carbon monoxide, nicotine, aldehydes, furfural, acrolein, formic acid. The reaction of the smoke is acid.

The quantity of carbon monoxide varies with the rapidity with which the cigarette is smoked. The quantity of nicotine that may enter the mouth further depends on how much of the cigarette is consumed. If only two-thirds of the cigarette is smoked the major part of the nicotine originally present in the whole cigarette will be found in the stub. The heat of this stub has been found to be around 60° C. under ordinary conditions of smoking. The streamline of the smoke from a smoldering cigarette will contain ammonia, which is one of the irritating agents to the eyes of persons sitting near by. The composition of the midstream is quite different from the streamline, both as to some of its constituents and concentration. If the smoker is of a nervous type, of the type that will consume a cigarette in a few minutes, the quantity of the combustion products in the inhaled smoke is much greater than that when it takes 10 minutes to smoke it.

The chemical constituents of the various tobaccos are found to differ as far as the percentage present is concerned. For example, the nicotine contents of some of the flue-cured tobacco will be as much as 2.5 per cent as against 0.86 in West Indian or 0.73 for Maryland grown tobacco. The other constituents vary in the same way so that an analysis of the inhaled smoke at any one time will have only a qualitative value in a study such as we have made. As we have tried to emphasize then, the differences in the manner in which the cigarette is consumed and the variations in the type of tobacco all go to complicate the study. But the work of Mulinos and Osborne points out one controllable factor, the effects of which we can study; that is the difference in the action of the oxidation or reduction products of glycerine and diethylene glycol on the mucous membrane of the oral cavity. We

have it in our power to make up a definite tobacco mixture to be used during the entire study. We should be able to come to some conclusion in the matter of these two chemicals if the human element can be controlled and the subjective observations excluded.

The oxidation products of glycerine may be roughly stated as consisting of glyceric, tartronic, oxalic, tartaric, acetic or formic acids, depending on the conditions under which oxidation takes place. By removal of two molecules of water, acrolein is formed, and by indirect separation of one molecule, glycidic alcohol or glycide.

The combustion products of diethylene glycol are probably in the main glycollic and oxalic acid. No acrolein is formed. However, acrolein does not enter into our discussion as it is found in all cigarette smoke no matter what hygroscopic agent is present. It is difficult to determine exactly what compound is formed when either glycerine or diethylene glycol is used in the mixture because of the varying conditions already mentioned. The evidence advanced by Mulinos and Osborne indicates rather definitely that there is a difference in the action of the combustion products of these two chemicals on the mucous membrane. These findings at first appear to be wrong as glycerine is used as one of the constituents of some throat gargles and as a healing application for external use. However, we are not dealing with glycerine itself but with its combustion products.

In starting to gather the information desired for the study we realized at the very beginning that we were dealing with human beings, which are the hardest experimental animals on which to obtain reliable data. The psychologic factor is bound to come in and while we depended as much as possible on the objective symptoms the observations on them in spite of all precaution are often colored in a study of this nature by the mental attitude of the observer. In order that this last factor might be ruled out as much as possible it was decided to ask a high type of medical man to select 10 men, whose reputations were such that no criticism could arise as to their ethical standing and observations. We were fortunate in obtaining the assistance of such a man, with the understanding that neither his name nor that of any of the other doctors

should be made public in any way, but remain absolutely confidential. The members of the committee were to report directly to him and their observations were not to be influenced by any external interference. It was agreed that each member of the committee should select 10 patients, who would report to him at regular intervals. The doctors were to select persons who had been smoking cigarettes of the popular brands for a number of years and which are known to contain glycerine as a hygroscopic agent. The patients were also selected because they presented certain definite symptoms that have been associated with smoking. These patients after an examination were placed on a brand of cigarettes which had replaced glycerine with diethylene glycol. The patients were placed on their honor not to smoke any other brand during the time they were on the experiment. The group consisted of professional men and women, artists, secretaries and a few from other walks of life. They had been smoking on the average 12 years and consumed approximately 28 cigarettes each per day. It was interesting in going over the reports of the groups to find how many of the patients changed from one brand of cigarettes to another from time to time because of the effect on their throats.

At the beginning of the experiment 73.7 per cent showed on examination a congested condition of the pharynx and larynx, 66.2 per cent had coughs, 7 per cent had an irritation of the tongue, 20 per cent gave a history of palpitation of the heart. It is impossible to give a quantitative evaluation of these conditions because of factors already discussed; but in each case the condition was readily observed.

After smoking the diethylene cigarette for from three to four weeks the congestion had disappeared in 62.3 per cent and the throat looked normal. The other 37.7 per cent showed considerable improvement. The cough disappeared in 75.6 per cent while in 26.4 per cent no change could be detected. The tongue conditions cleared up completely in each case. The heart condition will not be discussed in this paper.

In order to avoid the element of suggestion in the experiment the patients were given at the end of three or four weeks cigarettes containing the same mixture of tobaccos but in which the diethylene glycol had been replaced by gly-

cerine. This was done without informing the patients that it had been done. Eighty per cent showed a return to the congested condition of the pharynx and larynx inside of a week and in many cases the patient refused to continue to smoke them and the situation had to be explained to them. Only 34 per cent had a return of the cough and in practically every case the tongue condition returned. The results from clinical evidence show rather definitely that the combustion products of glycerine are more irritating to the throat than the combustion products of diethylene glycol, at least this was the common observation of the examining doctor in summing up his findings. I quote the observation of one doctor as an example: "With the diethylene cigarette there was a change in the appearance and symptoms of the mucous membrane of the pharynx and turbinate bones in all 10 cases. Some were more striking than others, but there was a definite change in all of these cases visible to examination. The glycerine cigarettes produced an irritation in the respiratorv tract which is noticeably absent in the diethylene ones."

An interesting case was reported by one of the doctors of a man who had gotten a "piece of shrapnel in the lung during the war and found that he could not smoke more than 10 cigarettes of the regular brand a day. If he smoked more than this number 'he had a congestion of the lungs as if he had a severe cold, irritation of the respiratory tract which would require two months to clear up.' When he was put on the diethylene cigarettes he increased the number smoked to 20 and 30 per day without noticing any effect on the lung tissue. An examination did not show any harsh breath sounds or any physical signs indicating an irritation or congestion in spite of the increased number he was smoking. He was changed to the glycerine cigarette without his knowing it and in a few days he had to cut down on the number he was smoking and complained of his lungs. On being put back on the diethylene cigarette the symptoms disappeared again."

We regret that the observations made by the group of 10 doctors were not in a shape to permit our tabulating them in a more scientific manner but the results remain the same. We have simply taken the clinical findings of the 10 men and analyzed them.

Summary: The combustion products of glycerine when it is used as a hygroscopic agent in cigarettes will under certain conditions cause an irritation of the throat.

The combustion products of diethylene glycol cause only a slight irritation, if any, of the throat. There is some evidence that they may be beneficial where irritation is present.

REFERENCE.

1. MULINOS, M. G., and OSBORNE, R. L.: Pharmacology of Inflammation; III Influence of Hygroscopic Agents on Irritation from Cigarette Smoke. *Proc. Soc. Exper. Biol. and Med.*, 32:241-245, 1934. This research was made possible through a grant by Philip Morris & Co., Ltd., Inc.

Department of Physiology, Columbia University.

AMERICAN OTOLOGICAL SOCIETY, INC.

The Sixty-eighth Annual Meeting of the American Otological Society will be held at the Royal York Hotel, Toronto, Canada, Monday, Tuesday and Wednesday, May 27-28-29, 1935.

The meeting will be followed by the meetings of the American Laryngological Association, May 29-31; the American Bronchoscopic Society, June 1, and the American Laryngological, Rhinological and Otogolical Society, June 3-5. All the meetings will be held at the Royal York Hotel.

A program of high scientific interest has been arranged which will include two important symposia, one having to do with the question, Is There Localization in the Cochlea for Low Tones? and the other on a Consideration of Certain Fundamentals in Regard to Suppuration of the Petrosal Pyramid.

Toronto is easily reached from all directions by rail and by automobile, and is a delightful place to visit in the summer.

For further particulars address Dr. Thomas J. Harris, Secretary, 104 East 40th street, New York.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTOLARYNGOLOGY.

Meeting of May 16, 1934.

Case Report of a Pseudo-voice, Probably Esophageal, Following Total Laryngectomy. Dr. Wallace Morrison.

Dr. P. E. S., age 50 years, had a total laryngectomy performed by Dr. Gabriel Tucker, of Philadelphia, on Nov. 22, 1933. The larynx, with the epiglottis and a small portion of the lateral wall of the hypopharynx on the left side was removed, with a squamous-celled carcinoma involving the left ventricular band, the anterior commissure and the base of the epiglottis, graded Type I. The T incision was used, every effort was made to preserve the infrahyoid neck muscles, and the esophageal wall in the lowest hypopharynx. Recovery was uneventful and the wound was healed in five weeks.

He was first seen on Jan. 17, 1934, eight weeks after the operation. His general condition was excellent; the tracheal stoma was of good size, and the anterior neck muscles were very well preserved. He had purposely made almost no attempt to produce the typical whisper of purely buccal origin, as advised by the author, but used pad and pencil to communicate with his friends. Instruction was begun in an attempt to have him learn a pseudo-voice, according to the method developed by the author based upon the work of Hugo Stern and others.

In eight days he had learned to swallow air in considerable amount, to regurgitate it and to produce a guttural sound with it. In seven days more, he was using the guttural sound so produced for the production of syllables and words, with very little effort. At present, after four months of exercise and practice, he talks at will, has resumed medical practice, can count up to ten or more on one swallow of air, and is very happy with the pseudo-voice. It is low-pitched and hoarse, but quite intelligible over the telephone and for all ordinary conversation.

COMMENT.

From our X-ray studies of this gentleman, we believe that the mechanism of the pseudo-voice production is largely esophageal. We have demonstrated that he can gulp at will, quite large amounts of air into the hypopharynx, the entire esophagus and even into the stomach, and that he can, in part, at least, by voluntary control, bring up this air for the production of his pseudo-voice. We have not been able to demonstrate the site of the pseudo-glottis, which all the authors upon the subject agree is very difficult to do, but from our study of the action occurring, and from the description given by the patient of his own sensations, we believe that his pseudo-glottis lies deep in the hypopharynx, perhaps quite close to the cricopharyngeus muscle at the upper end of the esophagus.

Comparing this type of pseudo-voice, which will continue to improve in strength and usefulness with constant use, with the artificial larynx, we note that it is always instantly available, it never gets out of order, it costs nothing to maintain, and is much more like the normal human voice than the sounds produced by any artificial larynx to date, and that it is something which adds enormously to the morale of the patient, since it is something which he himself has learned to form and over which he exercises full control, a personal possession, if you will, of the acquisition of which he can be truly proud.

DISCUSSION.

DR. S. FINEMAN: Dr. Morrison was kind enough to ask me to attempt to work out with him the mechanism of phonation in this patient. We carried out a few roentgenologic experiments which I will demonstrate to you. The observations are not yet complete and we intend to continue further work on this problem.

(Demonstration of X-ray films.)

The first film shows the soft palate, the air space above the tongue and the air space which ordinarily continues into the nasal passages. When the patient fills his hypopharynx with air, it becomes dilated and pushes the soft palate up against the posterior pharyngeal wall. The object of this maneuver is not clearly understood. In the cases described in the literature, the enlarging of the hypopharyngeal space and the action of the pharyngeal musculature, particularly of the inferior constrictor muscles of the pharynx, are said to serve in improving the vocal tone and in the gradual expulsion of air from the esophageal air reservoir. Somewhere in this region the false glottis is formed.

The second series of films were taken to show the changing size of the hypopharyngeal space when filled with air. The air-filled hypopharynx becomes an air reservoir. In some types of speech production, particularly in the buccal type, this air reservoir is used primarily for the production of the voice. However, when the esophagus and stomach are used as air reservoirs, the hypopharynx is used more as a resonator for modulation of the voice.

The next two films show the small amount of air normally present in the esophagus, and the remarkable dilatation of the esophagus by the air swallowed prior to phonation.

The next experiment was conducted as follows: The patient was asked to fill his esophagus with air and a Roentgenogram was made. Directly after he had spoken five words a second film was made. In this film, air is still seen to be present in the upper half of the esophagus, but is absent in the lower half. The patient was then asked to expel all of the remaining air. The last film shows no air left in the esophagus except a small amount at the extreme upper end. In the literature there is considerable discussion as to whether the stomach takes part in the production of the pseudo-voice. In this instance, we are unable as yet to say to what extent the stomach is used for voice production.

The next two slides show the amount of air ordinarily present in this patient's stomach and the large amount of air in the stomach after several voluntary swallows of air in the preparation for speech.

DR. W. W. CARTER: I wish to congratulate Dr. Morrison upon this excellent result. I note that this patient is a man of superior intellectual endowment, and I should like to ask Dr. Morrison if he would expect as good a result in a patient of ordinary, or I should say, average intelligence. It requires a great deal of co-operation on the part of the patient, and I should like to hear Dr. Morrison's opinion on that question.

DR. M. C. MYERSON: Our experience has been that a man must have a little superior intelligence and also must have a pretty good physique. Again, with a man in his upper fifties or sixties, unless he is very robust, one cannot expect him to speak in this way. I have a man who is now 68 or 69 years old, whom I operated upon in January, 1929. He can speak in this way. He had a myocarditis at the time of operation, and still has, of course, and he says it is entirely too much of a strain. It seems that the diaphragm comes into play very strongly in the production of this kind of speech and constitutes very much of a strain. I do not think the patient who is not strong physically can hope to speak in this way. Also, the individual who must speak this way must have some native mechanical ability.

DR. WALLACE MORRISON: There is no question that the intelligent patient will learn to produce the pseudo-voice more rapidly than the average run of so-called "clinic" patients, most of whom cannot be made to fully understand what we are trying to have them do; it is difficult for most laymen to understand the anatomy of the parts; many of them have not the tremendous urge to learn the pseudo-voice that this patient had. He is a surgeon, understood at once what we wished to have him do, and was more than anxious to get back to his surgical work; he practiced patiently and co-operated fully, and so learned to form the pseudo-voice in a very short time.

Other factors to be considered are: (a) age; it is well-known that advanced age is a time when learning is not easy; the acquiring of a pseudo-voice means that a number of adjustments must be made before the portion of the body used, but not intended by nature for any such purpose, can be brought under voluntary control. (b) Something of mechanical ability in the make-up of the patient is a great help; this type of person learns much for himself. (c) Body build has something to do with the ease of production of the pseudo-voice; the best voices are produced by those of robust build and with strong musculature; however, quite slight persons can learn the voice and develop the particular musculature needed in marked degree. Really asthenic types of course rarely have the musculature necessary for this voluntary act.

May I take this occasion to thank both my doctor-patient and Dr. Fineman for their great patience and effort put into the study we are making, in an endeavor to work out the details of the mechanism of the production of the pseudo-voice by radiographic means? We are able to report only a part of our results as yet, but hope to complete the study and give a full account of it at a later date.

The Correction of Recent and Old Fractures of the Nose. Dr. Gerard H. Cox.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. JAY D. WHITHAM: Mr. Chairman and Gentlemen: Dr. Cox has covered the subject so completely that I will make my remarks very brief. I think if everyone handled the cases of fractured nose as competently as Dr. Cox has handled his, that 50 per cent of the submucous resections would be unnecessary and at least 50 per cent of the nasal plastics would not need to be done. The reason that fractures of the nose are not well treated, generally speaking, by general practitioners who treat most of them, I think is because they do not understand the mechanism of it. The reason they do not understand the mechanism of it is that the surgical text books omit in almost every case an accurate description of it. There are two or three things that generally happen. (Diagram showing the nasal bones, the ascending process, the perpendicular plate of the ethmoid and the septum.) The simplest fracture is through one or both nasal bones. This drives the nasal bones down in between and makes the nose look very broad and flat. Nothing works better than Dr. Carter's splint to hold these fractures up and in position. The more common thing we see is a fracture which is the result of a blow in fighting or a fall on the side of the face. There the fracture occurs not so much of the nasal bones as in the ascending processes. There you have something like this (diagram). One fragment overrides the other and there is a big gap with one fragment depressed inward. The nose is twisted over to the side and the septum is dislocated to the side from which the blow came. It is therefore necessary to lift this fragment up and put it back in place and reduce the dislocated septum. This can be done under local anesthesia but is done preferably under general anesthesia.

Dr. Cox emphasized immediate treatment. The secret of success in most cases is in getting the treatment before the swelling occurs. You must spend a good deal of time in some cases before reducing the dislocated septum.

To correct the deformity resulting from an old fracture of the nose I prefer to make a small incision just exactly where the eyeglasses pinch the nose on each side. It is a very small incision and I have never had a case in which any scar showed. I use a very narrow chisel entered at that point and turned downward, cutting through each side and reducing the fracture in that way.

For the saddle back nose Dr. Cox very correctly advised cartilage transplants. I have had some success with ivory.

I would like to take a moment to demonstrate a few lantern slides. The first shows the method of anesthetic infiltration which we use. The two points of entry for the needle are sufficient to anesthetize the nose. The next is a case of a young girl who sustained a fracture following trauma plus a submucous resection which had preceded it. This shows the effect of ivory transplants. The next is a case of a boy in whom a rib cartilage transplant had been a failure and I put in ivory four years ago. The next picture is that of a girl, a simple traumatic case, in which I used a rib transplant. The next is a boy corrected with a rib cartilage transplant. The last picture is that of a girl who was injured in an automobile accident. There was necrosis of the interior of the nose. She never had a positive Wassermann. There was severe deformity. It was corrected by a forehead flap and rib cartilage transplant.

Dr. W. W. Carter: I did not expect to have anything to say tonight, but I appreciate your calling on me, and besides I have been interested in what I have seen thrown on the screen. I am glad that Dr. Cox and Dr. Whitham appreciate the operations that I devised some 25 years ago for treatment of these cases.

In regard to some of the pictures that were thrown on the screen, I really think that we should know definitely how long after the operation those photographs were taken. There are a number of considerations that one has to keep in mind which affect the permanency of these operations. First of all is the elasticity of the skin. The skin is extremely elastic and it has a tendency, after the correction, to reproduce the old deformity. No case may be considered permanently reduced under a year at the very least and possibly in some cases a good deal longer than that. The elasticity of the skin is greater the younger the patient, and it becomes negligible at about 44 years of age. It has a leveling tendency which pushes the nose down and reproduces the old deformity. Excellent results in almost any case may be shown if the nasal arch has been previously mobilized and if the photograph has been taken shortly after the removal of the copper splint, which I devised a number of years ago and which has been shown by Dr. Cox tonight. The permanency, however, of those primary results depends largely upon the operative technique and the precision with which the after-treatment is carried out. In determining these, time is an important consideration.

In regard to the rib transplantation, it is an operation which I devised about 28 years ago, and I have used it on a great many cases. A modification of this is to use two-thirds rib and one-third cartilage, removing the transplant at the junction of the rib with the cartilage. I have perfected this operation to such an extent that I get fairly uniformly good results. The cartilage end of the transplant is used in order to retain the resiliency of the tip of the nose, and I have found that the bone, within two months after the operation, has formed a bony union with the nasofrontal process of the frontal bone. The correction in these cases is maintained, and the bone is never absorbed if it is properly introduced. X-ray plates that have been taken by Dr. Law from time to time, in some instances 12 or 15 years after the bone has been transplanted, show that the bone is still alive and is performing its function of holding up the nose.

I would like to refer to the bridge splint apparatus that Dr. Whitham mentioned, and which I devised many years ago. This apparatus I think cannot be supplanted by anything that I know of, in recent fractures and in some of

the older fractures after they have been thoroughly mobilized. If it is used on the recent fractures, even though the nose is macerated or the bones have been comminuted, the full contour of the nose may be restored by the application of this bridge splint. You all know the manner of applying it and the principles upon which it works, so I will not go into a description of it.

I am very glad indeed to have listened to the presentation, Mr. Chairman, and I thank you.

Report on the "Anatomical Study of Two Hundred Petrous Portions of the Temporal Bone." Dr. M. C. Myerson, Dr. Hermin Rubin and Dr. J. G. Gilbert.

I need not tell you that the work which has been done in the past three or four years by Profant, Eagleton, Kopetzky and Almour, and Druss and Friesner, has stimulated interest in the petrous bone. Particularly are we indebted in this field to Eagleton and Kopetzky and Almour. I have always felt that a better understanding of a clinical subject can always be had by attention to the fundamentals in that subject. I speak particularly of anatomy, physiology and pathology. It was therefore decided that we would take advantage of the kindness and co-operation of Dr. Hala, Pathologist of the Kings County Hospital, and Dr. Marten, Senior Medical Examiner of Brooklyn, and with their co-operation study as many of the petrous portions of the temporal bone as possible in the morgue of the Kings County Hospital. When we reached 200 we stopped.

These bones were studied in more or less consecutive cadavers. Most of them were medical examiners' cases, a good many of them in colored individuals; the deaths were due to various causes. The procedure was somewhat as follows: The brain was lifted and the anterior surface of the petrous pyramid was inspected, and its relationships noted. A simple mastoid was done, a radical mastoid was done, and then the mastoid cavity and the cerebral surface of the petrous bone was brought into the same general field. Measurements were taken of the distances from the superior semicircular canals to the apex tip and of the internal lip of the internal auditory meatus to the apex tip. Dyes were placed in the tip cell of each pneumatized bone and note was taken of the cell channels into which the dye traveled.

The cellular channels were divided into supracochlear and infracochlear groups by an arbitrary line drawn through the longitudinal portion of the facial nerve. They were further subdivided as follows: The supracochlear was divided into anterior surface, superior border and posterior surface cells. The infracochlear cells were divided into anterior to cochlear, subcochlear and posterior to the cochlea cells.

Our study of the cell structure revealed 22 or 11 per cent, of pneumatized petrous bones and 76, or 38 per cent, pneumatized mastoids, showing that the mastoid and petrous do not partake of the same type of structure in the same bone. The cellular structures of the petrous portions are not the same in four of the 100 skulls studied. In several cases the petrous pyramid showed greater pneumatization than its corresponding mastoid. The pneumatic and diploic mastoids numbered 126, or 63 per cent, and the pneumatic and diploic petrouses numbered 44, or 22 per cent.

The course, position and relationship of the carotid artery in its bony canal was found to be constant, a finding of importance in its bearing upon the Kopetzky-Almour operation.

Landmarks: In all but two of the petrous pyramids we found the following arrangement to be constant. If the anterior surface of the petrous pyramid is studied we encounter the following sequence of landmarks along its superior border: an elevation, then a depression, then a second elevation and finally a second depression. The structures which are responsible for these landmarks are as follows:

First elevation: Eminence above the superior semicircular canal or eminentia arcuata.

First depression: Situated between the eminence above the superior semicircular canal and the external lip of the internal auditory meatus. Posteriorly it corresponds with the subarcuate fossa. Anteriorly it marks the location of the beginning of the greater superficial petrosal nerve as it leaves the genu of the facial nerve.

Second elevation: Upper lip and roof of internal auditory meatus.

Second depression: Petrous apex, upon which the Gasserian ganglion rests.

There was a greater relative incidence of pneumatized petrous pyramids in the skulls of colored as compared with those of the white patients.

DISCUSSION.

DR. RALPH ALMOUR: The presentation by Dr. Myerson, Dr. Rubin and Dr. Gilbert I consider a distinct contribution, and a close study of it, I am sure, will lead to a better understanding of the problems of petrous suppuration. The substance of the paper itself is a presentation of findings and facts, and these findings in themselves are not open to discussion. Consequently we have to discuss what these gentlemen had to give us from the inferences that we can draw, and the discussion resolves itself into two phases, the academic and the practical. I can only say that I not only agree with whatever has been shown here tonight in substance, but also agree with the side remarks that Dr. Myerson made.

From the academic standpoint a great doubt has been thrown upon whether or not the petrous pyramid is ever pneumatized. We believe that it is, but Dr. J. Gordon Wilson, of Chicago, states that until somebody shows him a lining membrane which is the same as that found in a mastoid cell, he will not concede that the petrous pyramid is ever pneumatized. He says that wherever these spaces are found, they are marrow spaces, and that in the preparation of these specimens, the marrow is washed out and leaves these spaces. From the academic standpoint again, I want to take one exception to what the gentlemen said. I do not believe in drawing conclusions from statistics in terms of averages and percentages, particularly here. We all concede that pneumatization is a continuous process, and we know that up to the age of 1½ to 2 years the pneumatization of the mastoid process is scant. Consequently the finding of no pneumatic spaces within the petrous bones of children under 1 year of age should not be considered by anyone in the calculation of the number of times that the petrous is pneumatized.

Approaching this presentation from the practical standpoint, we have changed our view since our original publication on this subject. We still believe that someone will show that these are really air spaces, but it really makes no difference whether they are pneumatic spaces or diploic spaces. I am very glad that Dr. Myerson included both these types because they show the number of instances in which a petrous suppuration can develop. However, for practical purposes we utilize the interpretations as afforded us by our Roentgenologist. His eye is trained to detect differences in density, very fine variations of density. By looking at an X-ray plate of the mastoid process he can tell you which mastoid process is pneumatic, which is diploic, and which is sclerotic. If he translates these same findings to the petrous bone, he can achieve exactly the same results and give you the same opinion.

Finally Dr. Myerson's paper furnishes three valuable points: The number of temporal bones in which a petrous suppuration can occur; the constant course of the carotid canal in the temporal bone; and lastly I believe he is

the first to give us definite landmarks for the middle fossa approach to the drainage of the petrous apex.

DR. JOSEPH G. GILBERT: I would like to discuss some of the comments of Dr. Almour. As to the question whether the large cellular spaces found in the petrous apex are true pneumatic cells or marrow containing cells, that is purely of academic interest. From a practical point of view, in our specimens when dye was placed in the pneumatized petrous apex it was seen to come out through the mastoid cells, indicating that there is a cellular connection or pathway between the petrous apex and mastoid cells. This occurred particularly in the superior border cells, posterior supracochlear cells, and the jugular bulb cells which directly communicate with the petrous apex on the one hand, and the mastoid cells on the other. By the same token a suppurative process from the middle ear or mastoid can extend by these cellular pathways into the petrous apex.

As far as the peritubal cells are concerned, great stress has been placed upon them by other authors. However, in our series we have only been able to demonstrate these cells in two specimens.

We did not attempt to arrive at any conclusion as far as age was concerned for we only wanted to demonstrate our actual findings, that is, in so many unselected specimens, irrespective of age, we found so many pneumatized mastoids and petrous bones.

Adenoma of the Bronchial Mucous Glands. Dr. B. M. Fried.

Benign tumors originating primarily in the bronchopulmonary tree are considered to be of rare occurrence. But sporadically appearing reports indicate that these neoplasms are not an uncommon disease. Some of these tumors lead to grave complications which obscure the primary cause of the malady. Many of them belong to the category of accessible or easily diagnosticated neoplasms and can be treated with gratifying results.

Of particular interest are adenomas originating from the cells forming the bronchial mucous glands. They are slowly growing, well circumscribed tumors having an alveolar structure. They are initiated by a pre-existing chronic inflammation of the bronchus or they represent a congenital anomaly.

As they originate in the mucous glands they are encountered in the wall of the larger bronchi and not in those which lack these glands. In their growth they usually advance toward the lumen of the bronchus, forming in the early stages a mammillary or polypoid projection. In the more advanced stages they assume a pyriform or a ball-like contour. They are covered with bronchial basal cells or with a layer of stratified squamous epithelium.

The symptomatology depends on whether or not the tumor obstructed the lumen of the bronchus. In the nonobstructive period it causes a severe cough resisting medication. Later on, there occurs soreness in the affected side of the thorax, a peculiar wheeze heard in the chest at the open mouth and abrupt and copious hemorrhages. In cases of stubborn hemoptysis with negative findings in the lungs or in the portal circulation, it is important to investigate the bronchi.

In the obstructive stage there occurs an atelectasis of the segment of the lung distal to the adenoma, this being followed by a pneumonitis, abscesses, bronchiectasis and pleurisy.

Although the tumor is histologically "innocent," its potential for producing complications is grave. Its presence can be detected in most instances by the bronchoscope. The removed material should be studied with utmost care for it is known that isolated sections may show features which resemble malignant disease.

The History of the Surgical Treatment of Otogenic Abscess of the Brain.
Dr. Leo M. Davidoff.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. CHARLES A. ELSBERG: There are two ways in which a paper, understanding, instructive and interesting as this is, can be discussed. One way is to tell what you have done and how during the course of years you have changed or modified procedures which you had previously used. The other method of discussion is to speak of what others have done. Dr. Davidoff has mentioned Macewen a number of times and has spoken of his remarkable surgical insight into the problem presented, in this instance, by brain abscess. Instead of saying what I have done in the course of years, I want to read to you a few remarks from a paper by Dr. Thomas Barr, published in 1887 in our Archives of Otology, on the first case on which Macewen had operated. It shows how well Macewen understood the problem with which he had to deal.

The patient was a boy, who, a number of weeks after middle ear disease and operation for an inflammatory process in the mastoid, developed his symptoms of brain abscess. Dr. Macewen was called in consultation. He agreed that it was a temporal lobe abscess on the right side, and here are a few words of his own description of the operation: "After the anesthetic had been administered, a ½ in. disc of bone was removed from the squamous portion of the temporal at a point 1½ in. above and ½ in. behind the center of the external auditory meatus. The bone was normal. The dura mater appeared slightly congested. When this membrane was opened and turned aside, the brain immediately bulged into the osseous cavity and rose above its external level, apparently shutting off the space in the meninges around it. A hollow needle was inserted in the brain in a direction which, if introduced far enough, would strike the eminence in the petrous bone above the middle ear. After we had penetrated the brain tissue for about three-quarters of an inch, there was a sudden escape of foul gas, accompanied by a bubbling sound and a few drops of fluid. Apparently the upper part of the abscess cavity had been tapped and this contained the foul gas and fetid pus. It was evident that there was a considerable zone of purulent inflammation and considerable pus at a lower level than the level reached by the needle in the abscess cavity. An aperture was then drilled in the base of the skull just above the osseous portion of the external auditory meatus, involving the squamopetrosal suture. The dura was intact. It was incised and the abscess cavity reached with the needle. A stream of boracic lotion was passed through this aperture, passing freely out through the tube in the other opening (above)." Decalcified chicken bone drainage tubes, to which Dr. Davidoff has referred, were then introduced through both apertures, thus draining the lower and most dependent part of the abscess. Macewen goes on to say later on that the tube remained in place for a number of weeks. As it was gradually pushed out, it was gradually shortened, and it was fully five weeks before the remains of the tube were removed. In other words, here is a classical description of the problem of a brain abscess and the principles upon which drainage should be instituted. There should be drainage at the most dependent portion, a tube remaining in place for a considerable period of time, no matter what variety of tube is used.

I take it that in speaking of drainage of abscesses Dr. Davidoff has arrived at the conclusion that drainage at the most dependent portion, by a properly inserted and fixed tube, is the essential principle in the surgical treatment of brain abscess. Here Dr. Macewen, almost 50 years ago, in the early days of operation for drainage of abscess of the brain, fully appreciated and recognized these essential principles and applied them in the very first case on which he operated.

(To be continued in a subsequent issue.)